December, 1949

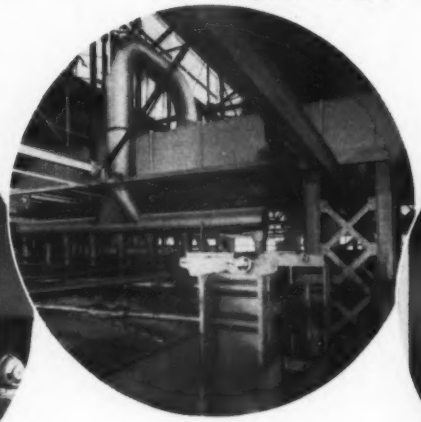
THE JOURNAL OF GLASS MANUFACTURING

the glass industry

KIRK AND BLUM ...ENGINEERED COOLING SYSTEMS

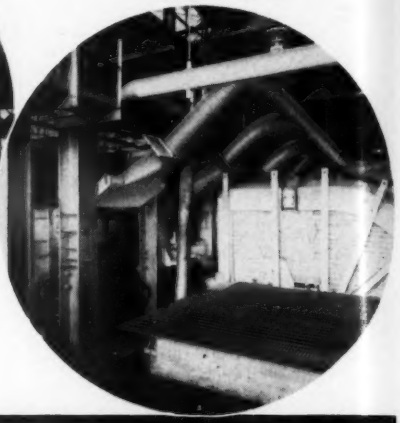
FOR THE GLASS INDUSTRY

Combustion Air System



Suspended Arch Cooling

Skew Beam and Port Cooling



THE DESIGN AND INSTALLATION of a good Cooling System is a job for Air Engineering Specialists, and the true value of the system will depend to a great extent on the ability and experience of the organization selected to do the work.

INITIAL COST is a function of equipment, materials and labor, and may be high or low depending upon the individual point of view — however, initial cost has little bearing on the true value of a cooling system when all evidence has received proper consideration.

RESULTS ACCOMPLISHED by the cooling system will be reflected in longer furnace life and increased production on machines; this represents the most important measure of true value and should be pro-rated over the probable life of the system.

OPERATING COST continues over the entire life of the cooling system and may represent twenty times the initial cost; operating cost is largely a payment for power, and the proper design of each and every part of the cooling system will influence the amount of this charge.

TRUE VALUE obviously must represent the profit from results accomplished less the sum of initial cost and operating expense.

***DEPENDABLE EQUIPMENT* will cost more to buy . . . in the long run less to own and less to operate.**

THE KIRK & BLUM MFG. COMPANY, 2804 SPRING GROVE AVE., CINCINNATI 25, OHIO

FRAZIER-SIMPLEX, INC.

Engineers

428 EAST BEAU ST.
WASHINGTON, PENNA.

ENGINEERS *to the* GLASS INDUSTRY

SIMPLEX BLANKET BATCH CHARGER MEANS BETTER GLASS WITH INCREASED PRODUCTION

- Spreads and forwards materials across feed opening in a shallow uniform blanket to provide maximum exposure to flame for faster melting.
- Reduces radiation losses.
- Minimizes dusting of furnace atmosphere.
- Prolongs refractory life.

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SIMPLEX EQUIPMENT

Complete Glass Manufacturing Plants
Modern Ventilated Steel Factory Buildings
Designs . . . Appraisals

AN OGDEN PUBLICATION DEVOTED TO GLASS TECHNOLOGY, ENGINEERING, MATERIALS AND GLASS FACTORY EQUIPMENT AND OPERATION

the glass industry

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ONE TANK'S PERFORMANCE OVER 21 YEARS

THE statistics below give the performance figures of *one* glass furnace, melting flint glass, for thirteen consecutive fires, over a period of twenty-one years.

It is a record of progress made possible by advances in furnace design and operation, and in the use of better refractories.

Corhart Refractories, Company, *Incorporated*
16th and Lee Streets, Louisville 10, Kentucky

The words "CORHART," "ELECTROCAST," "ZED," and "ZAC" are Trade Marks which indicate manufacture by Corhart Refractories Company, Incorporated.

PERFORMANCE DATA FOR ONE TANK OVER A PERIOD OF 21 YEARS

	1	2	3	4	5	6	7	8	9	10	11	12	13
LIFE	7 Months	8.2 Months	10 Months	16 Months	13.6 Months	13.4 Months	20 Months	16.6 Months	17.1 Months	24.6 Months	27.1 Months	32.7 Months	29.7 Months
DATES	JAN. '28 JULY '28	SEPT. '28 MAY '29	JUNE '29 APR. '30	JUNE '30 SEPT. '31	NOV. '31 DEC. '32	FEB. '33 MAR. '34	MAY '34 DEC. '35	JAN. '36 JUNE '37	JULY '37 NOV. '38	FEB. '39 MAR. '41	APR. '41 JULY '43	SEPT. '43 MAY '46	JULY '46 DEC. '48
MATERIALS	All Clay Tank—15" Sidewalls	All Clay Tank—15" Sidewalls	Corhart Standard Throat and 12" M.E. Breast—all Underpaved—15" Clay Sidewalls	Corhart Standard Throat and 12" M.E. Breast—Corhart Checkers—Clay M.E. Lower Course	Corhart Standard Throat and 12" M.E. Walls	Corhart Standard Throat (12" M.E. Walls Plus ZED Sill & Bottom	Corhart Standard Throat (12" M.E. Walls and M.E. Bottom (12")	Corhart Standard Throat (12" M.E. Walls and M.E. Bottom (12")	Corhart Standard Throat (12" M.E. Walls Plus ZAC Sill and M.E. Bottom (12")	Corhart Standard Throat (12" M.E. Walls Plus All M.E. Bottom (12")	Corhart Zed Throat, Corhart Standard (12" M.E. Walls Plus All M.E. Bottom (12")	Corhart Zed Throat and Zac Flint Walls (12") Corhart Standard (12" M.E. Walls Plus All M.E. Bottom (12")	Corhart Zed Throat, Corhart Zac Flint Walls (12") Corhart Standard (12" M.E. Walls Plus All M.E. Bottom (12")
MELTING AREA (SQ. FT.)	834	834	834	834	834	834	834	854	854	834	834	834	834
TOTAL DAYS LIFE	212	246	300	482	405	413	600	500	514	738	813	967	890
TOTAL OPERATING DAYS	175	201	249	365	330	335	500	437	418	634	738	748	735
TONS GLASS DELIVERED	6648	8620	10356	16400	17561	19873	39134	47753	40861	53037	77485	69897	66767
TONS GLASS PER OPERATING DAY	37.99	42.89	41.59	44.93	53.22	59.32	78.27	109.27	97.75	82.98	104.99	93.44	89.48
SQ. FT. MELTING AREA PER TON GLASS PER DAY	21.9	19.4	20.3	21.8	17.8	16.5	10.7	7.8	8.7	8.2	7.9	8.9	9.3
TOTAL TONS COAL USED	4792	4810	6215	10540	10680	10908	19154	17176	17757	21179	32338	38102	35959
TOTAL TONS COAL USED ON OPERATING DAYS	3732	4187	5445	8630	9732	8892	17024	16002	15684	24544	30512	32923	29906
BTU PER TON GLASS DELIVERED	103348 x10⁶	89405 x10⁶	96802 x10⁶	96880 x10⁶	96785 x10⁶	82371 x10⁶	80089 x10⁶	61591 x10⁶	70665 x10⁶	86833 x10⁶	72495 x10⁶	84870 x10⁶	81476 x10⁶
COAL EQUIVALENT AT 13150 BTU PER LB (70% PRODUCER EFFICIENCY) (LBS. COAL PER LB GLASS)	561	486	526	526	526	447	435	335	384	472	394	461	443
NATURAL GAS EQUIVALENT AT 1000 BTU PER CU FT (PER TON GLASS)	10395	8943	9680	9688	9679	8237	8009	6169	7066	8683	7249	8487	8148
FUEL OIL EQUIVALENT AT 150,000 BTU PER GALLON (PER TON GLASS)	689	596	645	645	645	549	534	411	471	579	483	566	543

NOTE: This tank had a 40" metal line in all campaigns. The ware manufactured was flint containers.
Months of life calculated by dividing total days life, by 30

Cambridge
WOVEN WIRE BELTS MOVE

Open mesh of the Cambridge Balanced Belt on this annealing lehr permits free, even heat flow. Moving belt allows low-cost continuous processing.

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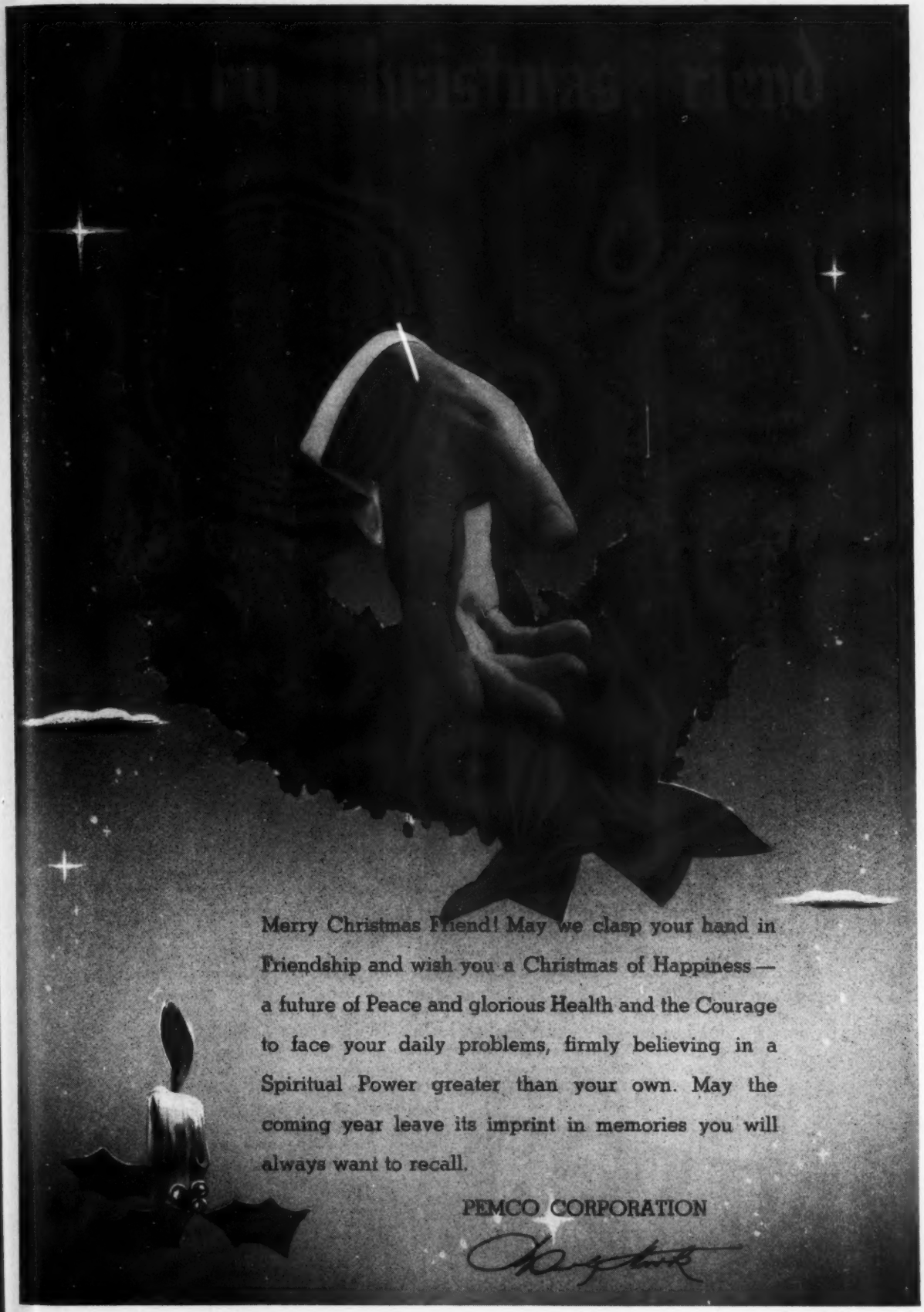
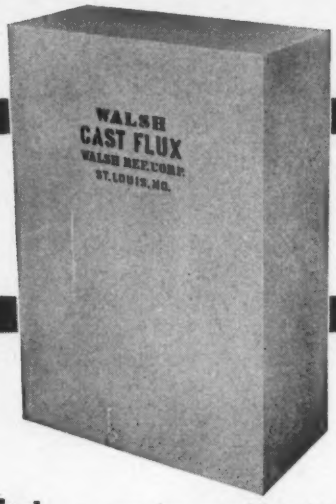

Merry Christmas Friend! May we clasp your hand in Friendship and wish you a Christmas of Happiness — a future of Peace and glorious Health and the Courage to face your daily problems, firmly believing in a Spiritual Power greater than your own. May the coming year leave its imprint in memories you will always want to recall.
PEMCO CORPORATION

Slash...

MELTING COSTS 5 WAYS WITH WALSH CAST-FLUX TANK BLOCKS



- **Lower Installation Cost . . .** precise machine trueing results in smoother surfaces, clean-cut edges and corners . . . for ease and speed in laying up.
- **Reduced Power Cost . . .** less air required for cooling means money saved on fans, motors and piping, with a consequent reduction in kilowatt hours of power consumed.
- **Lower Heat Transfer Value . . .** due to minimum heat conductivity insures better working conditions around the tank.
- **Longer Lining Life . . .** the result of superior composition, advanced methods of manufacture and "built in" resistance to fluxing—spearheaded by better research and ceramic engineering.
- **Reduced Fuel Costs . . .** per ton of glass melted. Many glass manufacturers report savings of from 15 to 20% over other types of glass tank linings.

The combination of desirable properties found only in Walsh CAST-FLUX Blocks is the reason why more and more glass producers are specifying money-saving Walsh CAST-FLUX, Vacuum Cast Tank Linings. For maximum service life at lowest cost insist on Walsh CAST-FLUX, the name that means "better glass for less."

Other Walsh products for the Glass Industry include:
C.S.R., Cast Sillimanite Refractory; Debiteuse; Refractory, Upper Structure Grade; Floaters; Pot Furnace Refractories; Prepared Clays; Fire Brick and High Temperature Cements.

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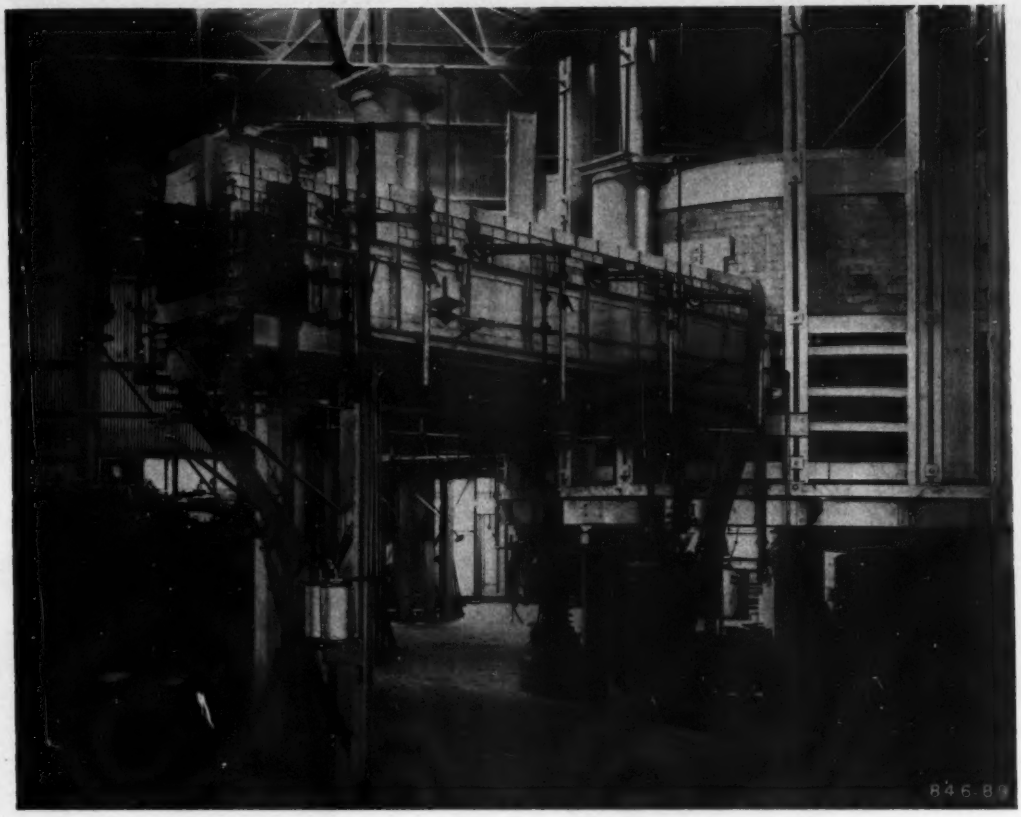

"Liberty" Gob Feeder

- Simple design and operation; low maintenance cost; no moving parts in contact with glass.
- Single or double gobs of uniform weight and shape.
- Simple adjustments for changes of gob weight or shape while operating; no cam or other mechanical changes necessary.
- Exclusive shear arrangement enabling shear to be positioned as desired, obviating moving of forming machines for double gobs.
- Adaptable to automatic or manual temperature control.

ARTHUR W. SCHMID COMPANY

Glass Plant Engineers

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DESIGN • ERECTION • OPERATION

the Morgan Ejector

—an economical, efficient, quick way to expel hot gases

- **Economical**...needs no costly stack and foundation, little maintenance.
- **Efficient** . . . Produces higher draft, maintains it at any volume, gets the most from any combustion equipment.
- **Quickly Installed**...No waiting for extensive alterations, gets the furnace back in operation with little delay.

Handles dust laden air, chemical fumes and gases that foul other systems. Ideal for use around airports. Stack is short. Creates no dangerous up-drafts because hot gases are mixed with cool air before being expelled.

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MORGAN CONSTRUCTION COMPANY - Worcester, Massachusetts

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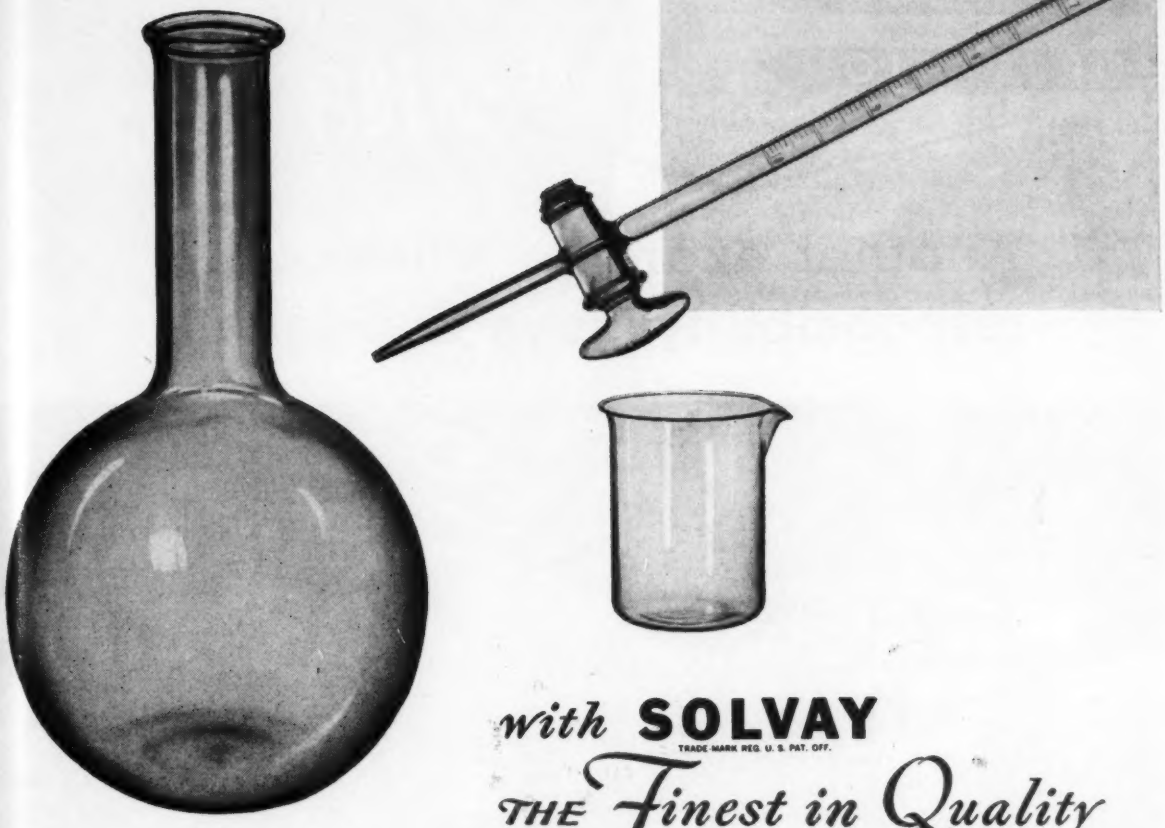

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TRADE-MARK REG. U. S. PAT. OFF.

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Granular Hydrated Potassium Carbonate

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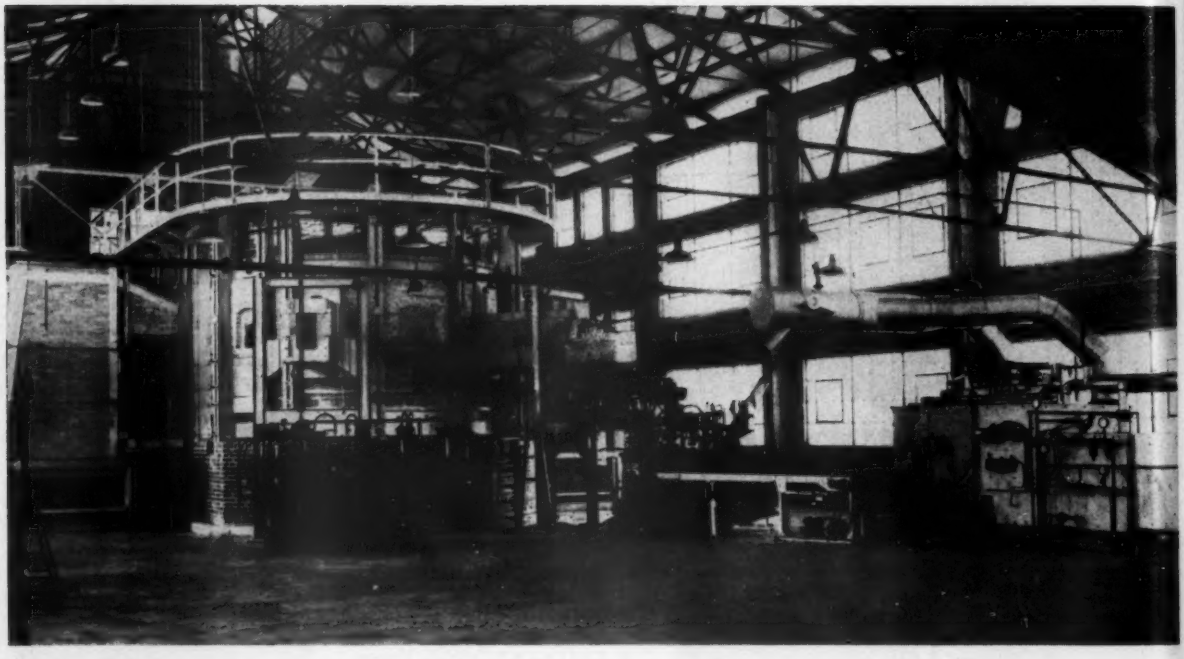
DESIGN
ERECTION
OPERATION

Another example where unit responsibility pays dividends



AMCO Installation During Construction Period . . .

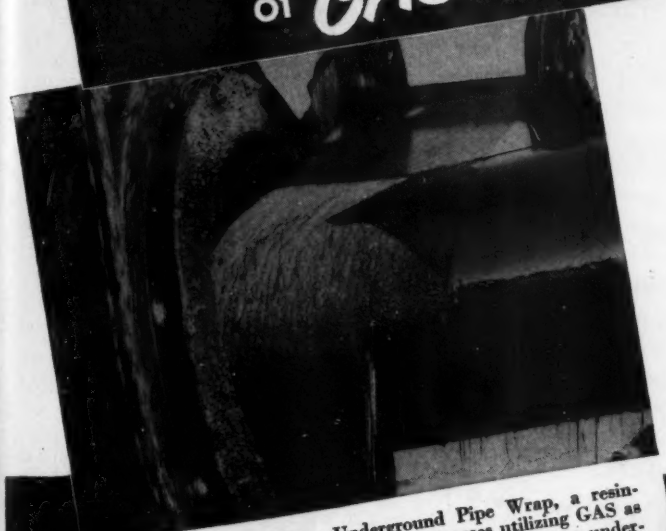
AMSLER MORTON
CORPORATION
Chamber of Commerce Bldg., Pittsburgh 19, Pa., U.S.A.

PHENOLIC CURING

PROCESS EMPLOYED BY

GLASS FIBERS, INC.

demonstrates controllability of GAS



VITRON* Glass Fiber Underground Pipe Wrap, a resin-bound mat, is made in a series of processes utilizing GAS as a fuel, and applied as corrosion-resistant wrapping on underground pipes. The photo was taken at 1/250 of a second, under actual field wrapping conditions, and shows how quickly the wrap is permeated and saturated by the hot coating.

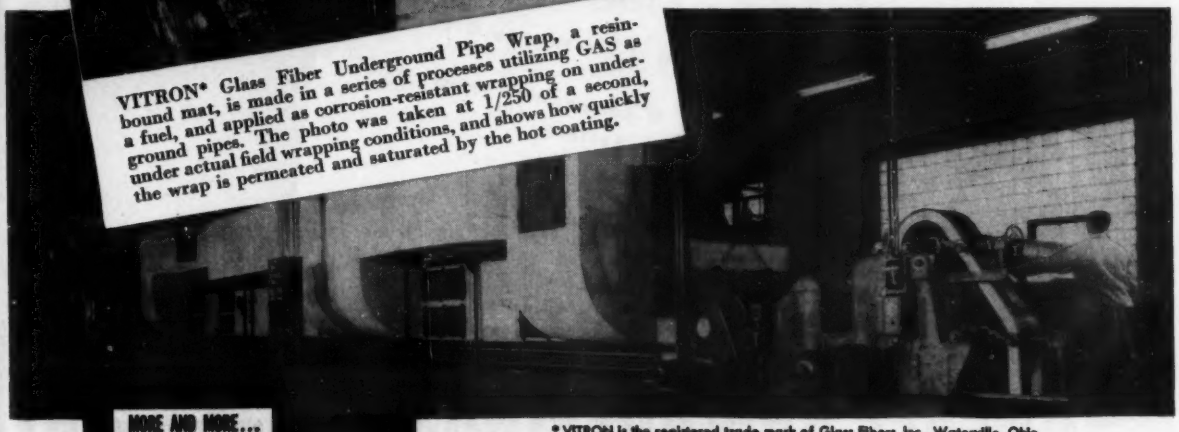
QUALITY CONTROL is directly related to time-temperature control in the production of VITRON* Glass Fibers. To obtain precise control of drying and curing cycles in the manufacture of this phenolic impregnated underground pipe wrap, executives of Glass Fibers, Inc. chose an automatic continuous GAS oven.

President R. H. Barnard expressed their choice of this all-purpose fuel as follows, **"We maintain extremely high-quality production standards for our VITRON Glass Fiber Underground Pipe Wrap. GAS, being easily controlled and highly versatile, is essential to our meeting those standards."** Of course, this Waterville, Ohio, manufacturer uses GAS in making the glass for the basic insulating mat so their engineers were well-acquainted with the efficiency and flexibility of this superior processing fuel.

With this experience in the application of GAS for production operations it was only natural that this versatile fuel should be chosen by Glass Fibers, Inc. for heat-processing the phenolic resin binder on the glass mat.

This highly-specialized application of GAS for production-heating serves to emphasize the versatility of GAS and its efficient utilization on a process requiring precise temperature control. As a fuel for high-speed heat processing under exacting conditions GAS meets every requirement. Your Gas Company Representative can show you many examples.

Continuous Gas-fired oven for curing phenolic resin on glass fiber mat.



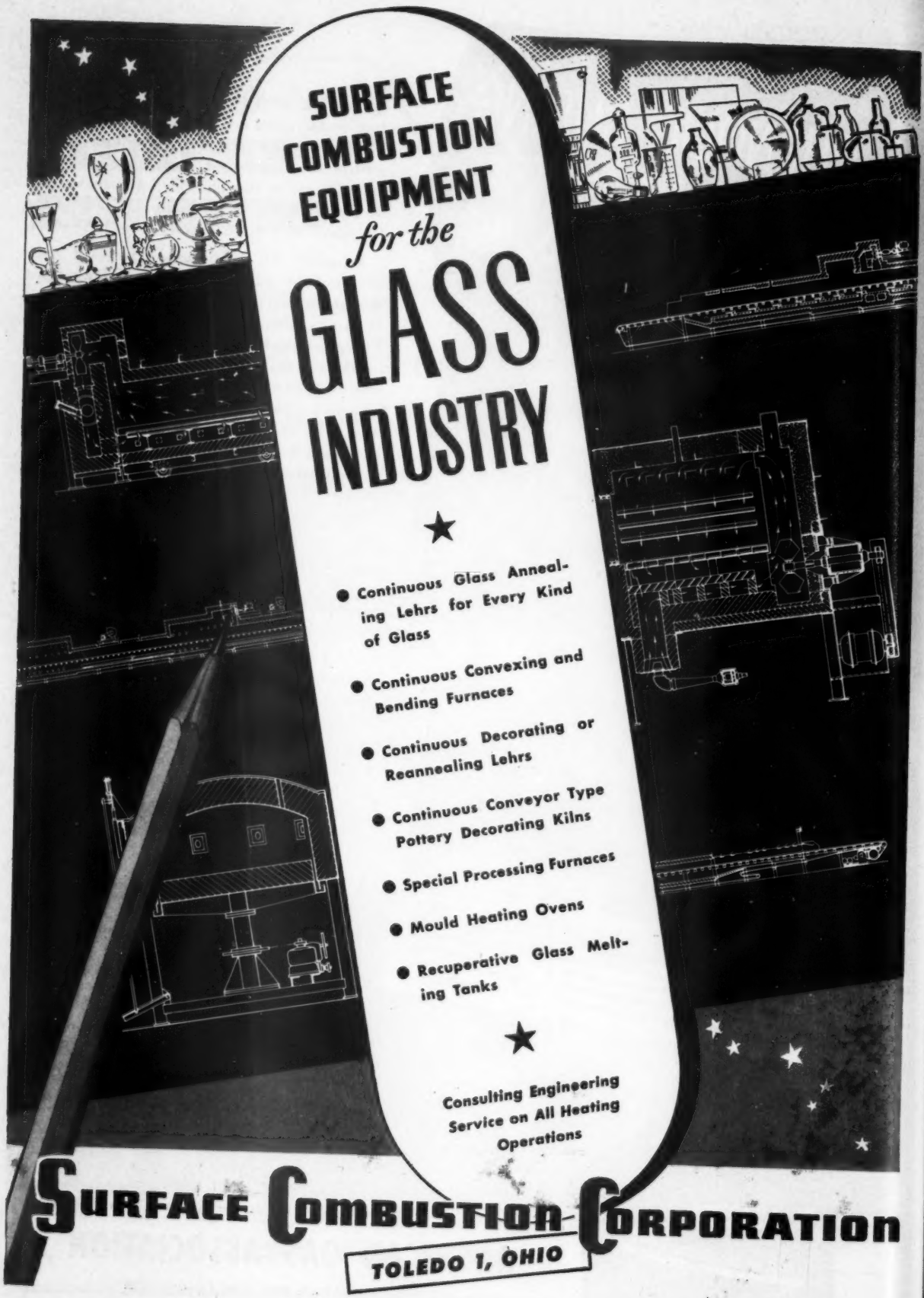
MORE AND MORE...

THE TREND IS TO GAS

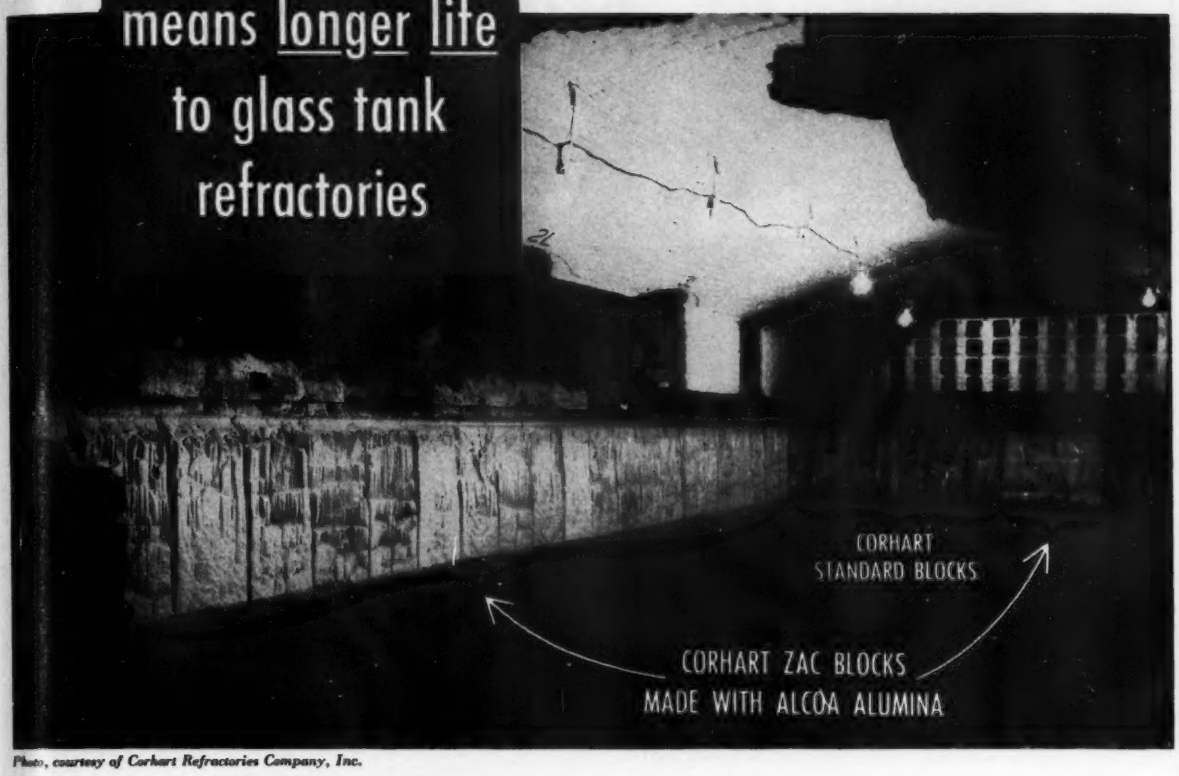
* VITRON is the registered trade mark of Glass Fibers, Inc., Waterville, Ohio

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK


SURFACE
COMBUSTION
EQUIPMENT
for the
GLASS
INDUSTRY
● Continuous Glass Annealing Lehrs for Every Kind of Glass
● Continuous Convexing and Bending Furnaces
● Continuous Decorating or Reannealing Lehrs
● Continuous Conveyor Type Pottery Decorating Kilns
● Special Processing Furnaces
● Mould Heating Ovens
● Recuperative Glass Melting Tanks
Consulting Engineering Service on All Heating Operations
SURFACE COMBUSTION CORPORATION
TOLEDO 1, OHIO

ALCOA ALUMINA means longer life to glass tank refractories



Photo, courtesy of Corhart Refractories Company, Inc.

This flint-glass container tank is another striking example of how ALCOA Alumina prolongs the life of high-temperature refractories.

The tank recently went down after a campaign of 834 operating days. During this time, 75,675 tons of glass were pulled for a tons-per-square-foot ratio of 110.5.

The CORHART ZAC sidewall blocks, fortified with pure ALCOA Alumina, could have run for another year, according to the operator. On the other hand, the bridge-wall, made of CORHART STANDARD blocks, *already had been patched.*

ALCOA Alumina gives refractories longer life, because it increases the resistance to spalling, abrasion and fluxing, as well as to corrosive slags and gases. Strength and stability under load at high temperatures are increased.

This higher operating efficiency *for the entire life of the refractory* actually makes blocks and bricks containing ALCOA Alumina the most economical you can buy!

Although we do not make refractories, we will gladly refer you to dependable sources. Many leading manufacturers can supply you with refractories containing various percentages of ALCOA Alumina to meet almost any operating temperature requirement.

Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 1467M Gulf Building, Pittsburgh 19, Pa.

Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

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• *A typical TECO Supervised glass melting installation.*

Bucking the HEADWINDS of COMPETITION is *UNPROFITABLE* with OUT-MODED EQUIPMENT for *MELTING GLASS!*

TECO ENGINEERS have proved the wisdom of a periodic check-up of glass melting equipment. This is profitably demonstrated by those enterprising concerns who have availed themselves of TECO Specialized Service.

TECO recommendations for replacement, remodeling or repairing of glass melting equipment to reap the full benefits of the latest developments in design and construction are available without obligation.

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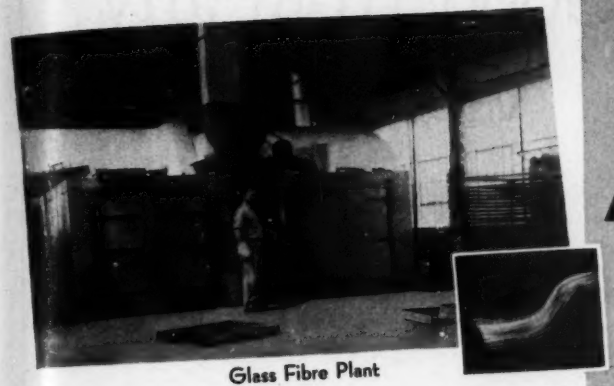
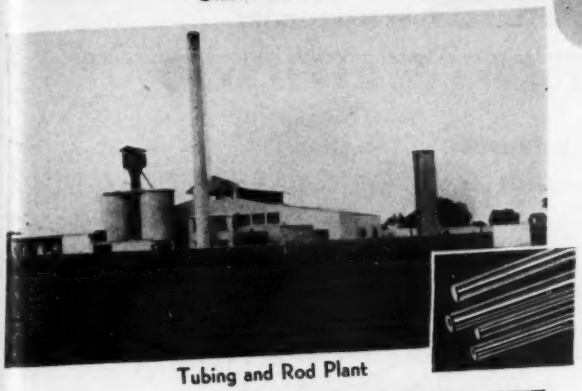
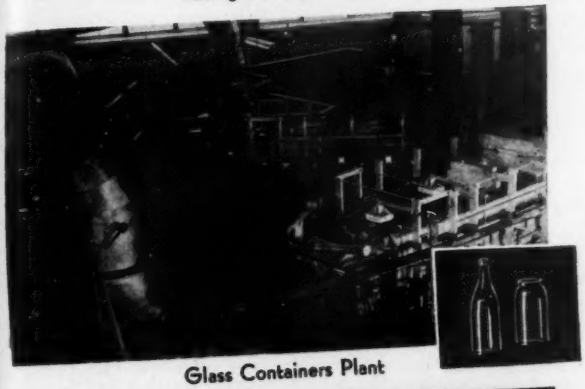
MODERN GLASS FACTORY INSTALLATIONS AND EQUIPMENT TO SUIT *YOUR* NEEDS



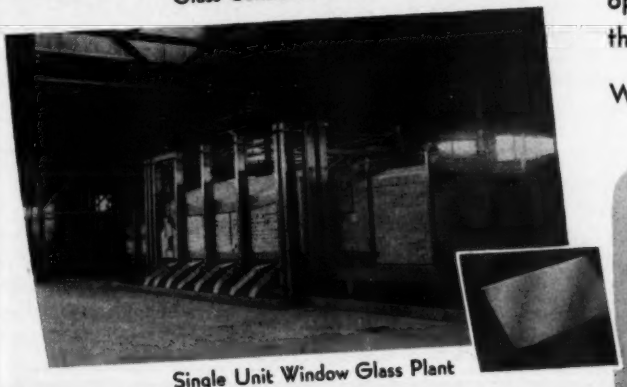
Glass Fibre Plant



Tubing and Rod Plant



Glass Containers Plant



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Our newly improved glass fiber drawing machine will meet your demands if you require the production of high quality glass fibers of varying thicknesses.

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Glass factory installations supplied by us are operating successfully in many countries of the world.

We solicit your inquiries.

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CAUSTIC SODA
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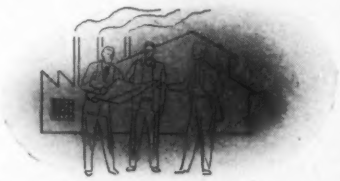
CALCIUM CHLORIDE
CAUSTIC ASH
MODIFIED SODAS
SODA BRIQUETTES
(Iron Desulphurizer)
PHOSFLAKE
(Bottle Washer)
SILENE EF
(Hydrated Calcium Silicate)
CALCENE T
(Precipitated Calcium Carbonate)
HI-SIL
(Hydrated Silicate)
PARA-DICHLOROBENZENE
ORTHO-DICHLOROBENZENE
MONO-CHLOROBENZENE
MURIATIC ACID
BORAX
PACIFIC CRYSTALS
(Sodium Sesquicarbonate)

FROM THAT OF YOUR MANAGEMENT—

Columbia policies foster profitable business relationships.



FROM THAT OF YOUR TECHNICAL STAFF—

Columbia manufacturing controls eliminate production difficulties arising out of variances in quality and grading.

FROM THAT OF YOUR PURCHASING DEPARTMENT—

Columbia plant locations and expeditious handling of your inquiries and orders assure fast service.

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PITTSBURGH PLATE GLASS COMPANY

THE GLASS INDUSTRY

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CONTAINER GLASS COMPOSITIONS – 1948

By P. A. WEBSTER and H. MOORE

Hartford-Empire Company, Hartford, Conn.

This is the third in a series of reports on the trends in container glass compositions.[1, 2] The 1947 report pointed out that major changes occurred in that year, due in large part to the shortage of soda ash. The study of trends in composition has now been extended to include 1948. The data presented in this report are based on chemical analyses and other tests of glasses from 64 furnaces. Of this number, 44 are flint glasses, 15 amber and 5 green.

The average composition and physical properties of glasses produced in 1948, and comparisons with 1946 and 1947 glasses, are presented in Table I. It is interesting to note that the low value for alkali reported for 1947 has carried through 1948 with practically no change. In fact, it may be concluded that the average compositions for 1947 and 1948 glasses are practically identical.

TABLE I.

Averages of Container Glass Compositions

Chemical Composition	*1946*	*1947*	*1948*
SiO_2	72.1	72.4	72.5
R_2O_3	1.8	1.9	1.8
CaO, MgO, BaO	10.1	10.5	10.4
Na_2O, K_2O, B_2O_3, SO_3, F_2	16.0	15.2	15.3
Test Results			
Homogeneity	B	B–	B–
Seed count per oz.	20	30	25
Chemical durability, H_2O	.035%	.031%	.039%
Chemical durability, Acid	.050%	.040%	.048%
Thermal Expansion x 10-7/°C	91	87	89

[1] Container Glass Compositions 1932-1946, H. Moore and A. K. Lyle, The Glass Industry, 28, 11 (563-566), Nov. 1947.

[2] Container Glass Compositions—1947, A. G. Allen and A. K. Lyle, The Glass Industry, 29, 9 (493-494), Sept. 1948.

The following comments apply to the trends in percentages for the major constituents.

Silica. It appears that the general trend toward lower silica, which was apparent for the period 1932 to 1945[1] at the rate of 0.13% per year, has now reversed itself. During the three year period, 1946-1948, silica increased 0.4%, or 0.13% yearly. A major factor in this trend toward higher silica has been the pronounced drop during the past two years in the percentages of alkalis, only part of which could be absorbed by the increases shown in lime.

Alumina, Lime, Magnesia, Barium Oxide. The total of these stabilizing oxides has shown increases of about .22% yearly between 1932 and 1947. The average value for the 1948 glasses is almost identical with that for 1947, and indicates that the use of relatively high lime is continuing for container glass.

The lime content is commonly derived from calcite, dolomite, or mixtures of the two, and sometimes from by-product slag. Further small quantities may be introduced through the use of fluorspar. Examination of the 1948 data indicates that 34 per cent of the glasses were calcite, 50 per cent dolomite, and 16 per cent a mixture of calcite and dolomite. The percentage of calcite glasses is about the same as in 1947, but it is evident that more glasses in 1948 contained only dolomite, and that fewer represented a calcite-dolomite mixture.

Soda, Potash, Boric Oxide, Sulfate, Fluorine. Allen and Lyle[2] pointed out the marked decline in percentage of fluxes for the 1947 glasses, brought about mainly by the shortage of soda ash. The decline in these constituents from 1946 to 1947 was 0.8%, as compared with an average annual decrease for the period 1932 to 1946 of .09%. The 1948 glasses show the continued use of low percentages of fluxes, the average agreeing almost exactly with that for 1947.

Distribution charts (Figs. 1 to 8) for most of the com-

mon constituents provide an interesting picture of the range for the individual elements.

Silica, Figure 1, is found most commonly in the 72-73% range. In comparison with the 1947 glasses, there are fewer glasses containing 73-74%, but a substantially greater number in the 74-75% range. With very few exceptions, container glasses are limited to silica contents between 70 and 75%.

Alumina, Figure 2, as in 1947 is found in most glasses in amounts between 1.0 and 2.5%. The majority of glasses in 1948 showed between 1.5-2.0% alumina.

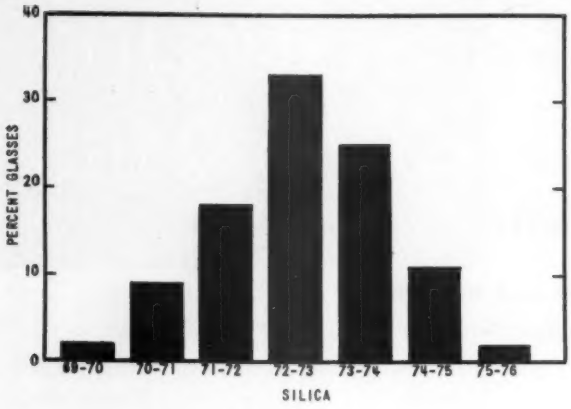

Fig. 1

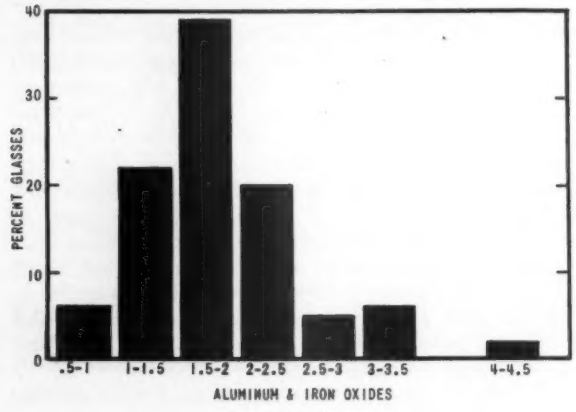

Fig. 2

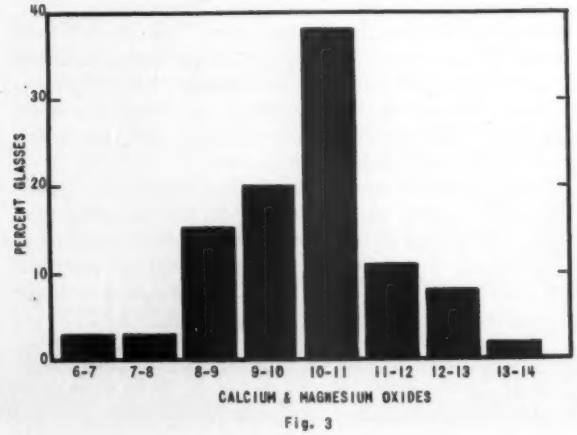

Fig. 3

Lime and Magnesia, Figure 3, is found most commonly in the range of 10-11%. Percentages of 8 to 10% and 11 to 13% are less frequent than in 1947.

Sodium and Potassium oxides, Figure 4, is found in amounts of 15 to 16% total alkali in the largest group of glasses. As in 1947, about 50 per cent of the glasses continue to show low alkali values, in the range of 12 to 15%.

Barium oxide, Figure 5, in amounts greater than 0.05%, is present in 81 per cent of the 1948 container glasses. The average amount used, in glasses containing the oxide, is .40%, and the percentages range from .05 to 1.0%. The distribution chart shows that except for trace quantities the greatest number of glasses contain .4 to .5% barium oxide.

Boric oxide, Figure 6, in amounts greater than 0.05%, is found in 42 per cent of the 1948 glasses. The average percentage, for glasses containing boron, is .37%, and the amounts range from .05% to .86%. The distribution chart shows that for glasses containing appreciable boron, the most common percentage is .2 to .3, as compared with .6 to .7% for the 1947 glasses.

Fluorine, Figure 7, in small amounts ranging from .02 to .47%, is found in seventy-five per cent of the 1948 glasses, averaging .20% for the glasses containing the element. Disregarding trace quantities, the most common percentage found in the 1948 glasses lies between .2 and .3%.

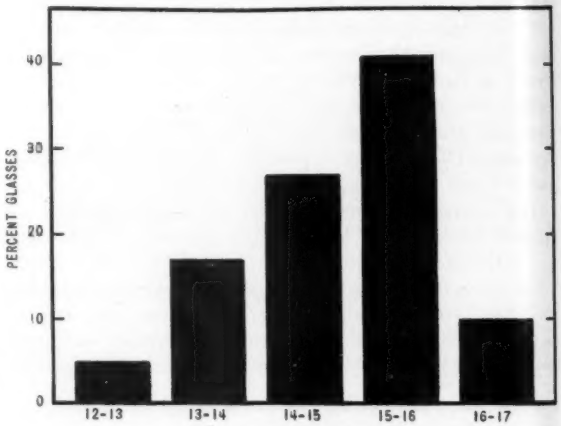

Fig. 4

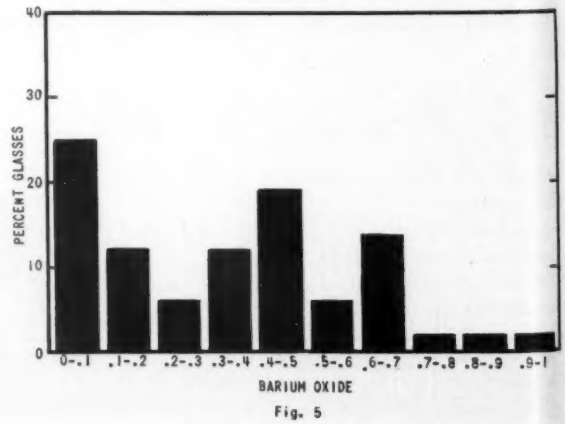

Fig. 5

Sulfate, Figure 8, in appreciable amounts is found in all of the flint and green glasses. The 1948 percentages range from .08 to .41% and average .23%. These figures agree closely with those reported for the 1947 glasses. However, in the matter of percentage distribution, the greatest number of glasses in 1948 contain .2 to .3%, and there is a noticeable decline in the number of glasses containing between 0.1 and 0.2%.

In general, it may be said that container glass manufacturers have, for the most part, adhered to the low-alkali compositions that were introduced of necessity in 1947. Fluorine continues to be used very commonly, in small amounts, as an aid in the melting and fining of these low-alkali compositions. The container glass industry thus continues to prefer the desirable qualities and all round performance of these up-to-date glasses. In general, they provide faster forming rates, greater resistance to thermal shock, and good resistance to chemical attack.

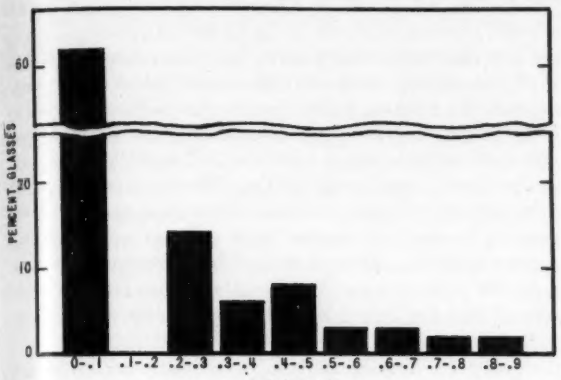

Fig. 6

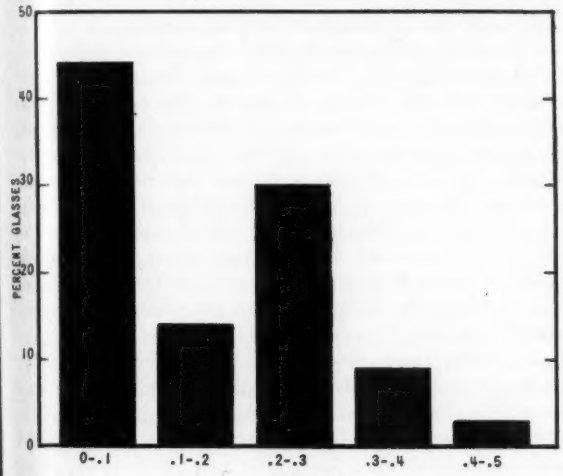

Fig. 7

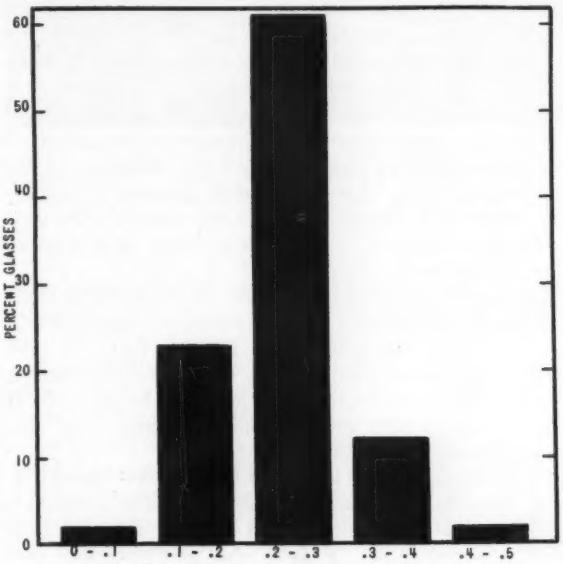

Fig. 8

THERE *IS* A GLASS PLANT IN FLORIDA

The Florida State Advertising Commission may have found itself with a red face following its apparently premature news release, picked up by the press, headed "Florida Sees Urgent Need for Glass Factory".

The release said that a survey was being made to determine the existing market in Florida for a glass factory and went on to report that a preliminary survey indicated a "desperate" need for one.

Meanwhile, Antonio Scalise, owner of the Tropical Glass & Box Company in Jacksonville, Florida, took space in the newspapers and ran an advertisement declaring, "Wake Up, State Advertising Commission. Jacksonville Has Had A Glass Factory Since 1926!" The advertisment gave a resumé of Mr. Scalise's activity in connection with glass manufacture in Florida and featured a picture of the Tropical Glass & Box Company plant. We suppose that some of Florida's desperation will be eased by Mr. Scalise's facilities.

AGA ELECTS BOARD OF GOVERNORS

The American Glassware Association has announced the results of the recent election for its Board of Governors. Calvin B. Roe, Director of Fostoria Glass Company, has been elected Governor for Life.

Governors at Large are Charles L. Gaunt, President of Indiana Glass Company, and Carl W. Gustkey, President of Imperial Glass Corporation. E. A. Donnan, President of The Federal Glass Company, was elected Alternate Governor.

Representing Active Divisions on the Board are C. W. Carlson, President of United States Glass Company, representing Hand Made Glass Table, Stemware and Ornamental Ware; J. Nelson McNash, Sales Manager Tableware Division of Hazel-Atlas Glass Company, representing Automatic Machine-Made Tumblers, Table, Kitchen and Cooking Ware; and Charles W. Gleason, President of Gleason-Tiebout Glass Company, representing Illuminating Glassware.

THE GLASS DIVISION AT THE PACIFIC COAST REGIONAL MEETING

The second West Coast Regional Meeting of the American Ceramic Society got under way the forenoon of October 19 with addresses of welcome by the local chairman, P. W. Dager, and by H. M. Kraner, President of the American Ceramic Society. Dr. Morrough P. O'Brien, Dean of the College of Engineering at the University of California at Berkeley, outlined the general objectives in the training of engineering students, emphasizing extension instruction and the values of a cooperative program.

Dr. Joseph A. Pask, also of the University of Berkeley, supplemented Dean O'Brien's remarks by describing more specifically the purpose, structure and functioning of the recently established Department of Ceramics and the value of cooperation from industry.

The final address of the General Session was made by Dr. J. F. McMahon, Dean of the New York State College of Ceramics at Alfred University, on "Technical Papers". This was a masterpiece of real humor and sound advice.

Professor Whittemore, the previous President of the Society, spoke briefly on behalf of the Institute of Ceramic Engineers, and Charles S. Pearce, the General Secretary, reviewed the growth of the Society on the basis of membership and scope of activities.

Registered attendance was 409. Most of the ceramic schools in the country were represented. Attendance at the three sessions of the Glass Division exceeded 1947 representation and gave evidence of the increased interest in manufacturing and technical problems by the staffs of the several container plants in the Los Angeles area. The East also was well represented.

The first session of the Glass Division was devoted to tank operating and structural problems. Claire Chaffee, of Industrial Furnaces, opened up the session with a down-to-earth review of facts and problems that face most manufacturing plants placing particular emphasis on inadequate control of combustion and its effect on the life of the tank as well as on the quality of the product. Ray Gentry of Alexander H. Kerr & Company, Wolfram Seitz of Glass Containers Inc., and Glenn Henning of Maywood Glass Company commented on other phases of structure and operating practices with particular reference to increasing tank life. The advantage of super-duty over standard checker brick is still a controversial subject, and on the West Coast more experience is needed before definite conclusions can be drawn. Both H. E. Primm and R. G. Abbey discussed this phase of tank structure and supplemented their remarks with lantern slides showing typical installations throughout the country. Good sized installations of the three most prominent types of super-duty checker brick are being made in California, and more conclusive evidence is hoped for by 1952.

The application of used cast refractories was discussed by Harold Baque of Corhart Refractories Company. Mr. Baque's color slides show typical installations throughout the country.

In line with the country-wide interest in electric melting, H. H. Douglas of the Southern California Edison Company reviewed this subject from the point of view of the supplier of electric power. Later on in the program, E. S. Campbell of the Northwestern Glass Company, Seattle, Washington, briefly commented on his experience with melting amber glass electrically and pointed out that they are proceeding with a second installation.

The second session of the Glass Division was devoted to technical problems of a more diversified nature. C. H. Boswell opened this session with a paper on statistical quality control as applied to the glass container industry from the point of view of a consultant more familiar with other industries than that of the glass industry. Mr. Boswell was followed by Eugene Fuller of Ball Brothers Company of Muncie, Indiana, who discussed statistical quality control as applied to the inspection of ware in the packing room. This type of control which is comparatively new to the glass industry functions as a direct aid to production, and will unquestionably form the subject matter of future papers at glass meetings.

Unusually good photographs of crystalline formations in glass provided the subject matter for a paper contributed by the Toledo Research Laboratory of the Owens-Illinois Glass Company. These photographs afforded the audience an insight into devitrification formations in glass in an unusually concise and interesting manner. Another contribution of the Owens-Illinois Glass Company was presented by W. A. Mahaffey of the Oakland Plant. Mr. Mahaffey discussed the applicability of light transmission measurements to the control of color in flint glass. Charts showing the effect of such ingredients as selenium and cobalt oxide on the transmission of light were presented in a very instructive manner and the application of this method to color problems created a great deal of interest on the part of the technical men present. The industry needs more practical presentations of this type.

The last paper of the second session was presented by T. W. Griffin of the Hartford-Empire Company who discussed developments of feeders and application to forming machine operation. This subject was very timely as many production problems originate in poor feeder operation.

The Glass Division took advantage of the presence of Hartford-Empire's Tommy Griffin in the Los Angeles area by calling a special meeting to hear Mr. Griffin talk on "Glass Feeding and Related Problems". This meeting was held at the Hacienda Country Club near Whittier on October 25 and was attended by about fifty representatives from local factories. Mr. Griffin briefly outlined the development of the feeder and then conducted a "Clinic" on operating practices on the basis of questions from the audience. This discussion was of immediate interest to everybody present and was actively participated in by operating groups. Mr. Griffin worked into his remarks many operating experiences with particular reference to troubles experienced because of misunderstanding of the principles behind feeder operations.

The third session in the Glass Division was of a more general nature in that it was devoted to processes, products and applications. V. H. Remington of B. F. Drakenfeld & Company gave his usual instructive talk on glass

of the manufacturing group as some of the samples on display have not been duplicated on the West Coast. R. L. Cheney of the Glass Container Manufacturers Institute discussed the economic status of the glass container industry, commenting on the relationship between decorating processes and supplemented his remarks with samples. A great deal of interest was shown on the part increased production and population increase. The interest shown in this paper would suggest that a similar paper should be given at future glass meetings so that the members of the industry can be kept up to date on this matter. T. J. Thompson of the Corning Glass Works discussed new products in glass and new applications. This talk was well supported with samples which included many never before shown in the Los Angeles area. Particular interest was shown in "Thirsty" glass and sensitized glass.

Dr. W. Smiley of the Stanford Research Institute discussed recent advances in the constitution of glass and pointed out the theoretical aspects of producing photographs in sensitized glass. Dr. Smiley discussed the structure of glass from a theoretical point of view and developed this intricate subject in a way that was readily understood by most everybody present.

One of the outstanding sand processing plants of the West Coast is at Corona, California. Starting with a material that has little resemblance to the finished product, the Owens-Illinois plant has been turning out a good quality product for both flint and amber glasses. The functioning of this plant was described by P. J. Oertel who showed both operation and equipment in a color film. Particular emphasis was placed on the amount of material required to turn out the finished product. The final paper of the Glass Division was a three minute discussion of "Lightning Tracks on Mirrored Glass". This paper reviewed an intricate problem encountered and solved by the Preston Laboratories of Butler, Pennsylvania. Don Riebe of Alexander H. Kerr and Company made this presentation.

The attendance at the banquet on Thursday, October 20, approximated that of the national meeting. The principal speaker was Dr. A. Polyzoides who discussed "America's Real Position in the United Nations". Dr. Polyzoides is well known in the Los Angeles area through his daily column in the Los Angeles Times, and through his connection with the University of California.

Meeting of the Glass Division of The American Ceramic Society. R. L. Cheney, Glass Container Manufacturers Institute, is shown addressing the group.

Dr. Whittemore formally presented Victor C. Swicker with a certificate of membership as a Fellow of the American Ceramic Society.

In 1950 there will be a Regional Meeting of the West Coast American Ceramic Society at San Francisco and in 1951 a meeting is scheduled for Los Angeles. The increasing interest on the part of the West Coast factories and educational institutions in this program and the attendance from other parts of the country indicate that future meetings will be well attended.

OPTICAL MEASUREMENT INSTRUMENT DEVELOPED AT BUREAU OF STANDARDS

A new instrument, developed by Dr. Francis E. Washer of the National Bureau of Standards, to measure spherical and chromatic aberration in lenses is proving very useful for the rapid testing of industrial eye-protective goggles and sun glasses, according to a recent report by the Bureau.

When the properties of the new instrument were investigated, it was discovered to be ideally suited for the rapid measurement of the small refractive powers of goggle and sun-glass lenses. The instrument also provides complete information on spherical and chromatic aberration in less than an hour for an average lens. To obtain equivalent results by an optical-bench method would require four hours or longer. The new instrument rapidly measures the refractive powers of eye-protective lenses to the nearest hundredth of a diopter.

Longitudinal spherical aberration is defined as the variation in focal length for different annular zones of a lens. The instrument developed by the Bureau determines this property by use of diaphragms which readily isolate successive zones of the lens. Then, if the lens under test is not in focus for the given zone, the image of a reticle, consisting of an illuminated cross, is doubled on a viewing screen. The procedure for testing a lens thus involves the location of the single-image position of the reticle for each zone of the lens.

OSCAR ZEILLER, DRAKENFELD DIRECTOR, PASSES AWAY AT 80

Oscar F. Zeiller, Director of B. F. Drakenfeld & Co., Inc. died at his home at the age of 80 after sixty-two years of association with the company.

Mr. Zeiller was born in 1869 and joined the firm in 1887. Although retired in 1940 as Vice President, he retained his directorship and took an active part in the business until shortly before his death.

DECORATION OF GLASS AND CERAMIC ARTICLES BY XEROGRAPHY

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Graphic Arts Research Div., Battelle Memorial Institute, Columbus, Ohio

Introduction

One of the unique characteristics of xerography is the possibility of preparing images on nearly any type of material—including glass and ceramic surfaces. While many other methods are available and in use for the decoration of glass and ceramic articles[1], it is believed that xerography has several features which may simplify the decoration process in certain applications. It is the purpose of this paper to review xerography and to indicate these various possibilities.

Xerography[2] is generally considered as consisting of two distinct phases. In the first of these forms it is used as a photographic process. The xerographic plates may be used to make photographic reproductions by either contact or camera exposure. In the second form, xerography can be used in making multiple copies of a single subject. Here it is analogous to the various forms of duplicating and printing. This application is referred to as xeroprinting.

Xerography has a number of characteristics which make it fundamentally different from any other reproduction process. It is completely dry. There are no chemical reactions or chemical solutions involved. The plates or films are not destroyed by the action of light but may be reused a number of times. It is a direct positive to positive process and does not require the use of an intermediate negative. Prints can be made on metal, wood, glass, ceramic, plastic and cloth surfaces, as well as many types of paper. Finished prints can be prepared in a matter of seconds.

Review of Xerography[3]

The photographic aspects of xerography involve the formation of an electrostatic latent image on a layer of photoconductive insulating material and the development of the image with a finely divided powder. The powder adheres to the electrically charged areas of the plate. The plate is sensitized by applying an electrostatic charge to the photoconductive coating with a corona discharge unit. The sensitized plate is then exposed to the light image of the subject to be reproduced. Where the light strikes the photoconductive coating the electrical charges are reduced in proportion to the amount of light falling on the particular area. This leaves a latent electrostatic image. The image is developed by dusting with a finely divided powder which adheres only to the electrically charged areas in proportion to the amount of charge remaining on the plate after exposure to light. The prints are made by transferring and fixing the powder image to paper or some other material.

The photosensitive plate consists of a photoconductive coating on a conductive supporting medium such as metal. The developer consists of a finely divided powder mixed with a coarser powder (Figure 1). The coarser powder serves to generate an electrostatic charge on the fine powder. The fine powder is then used to develop the image.

Review of Xeroprinting[3]

Xeroprinting employs a plate consisting of an insulating image on a conductive backing. When this plate is passed under a corona discharge unit (Figure 2), the electrical charge from the corona remains on the insulating or printing surfaces but not on the conductive or nonprinting area of the plate. Powder is then cascaded over the plate. Powder particles adhere to the charged insulating image but not to the uncharged, nonprinting areas. Paper is then fed into contact with the plate. As the paper and plate are passed through the corona discharge unit, the powder is electrostatically transferred from the plate to the paper.

Decoration by Xerography

The decoration of glass and ceramic articles by xerography involves the same steps outlined above. These

Fig. 1. Photomicrograph of xerographic developer showing the two components; the large particles are the carrier and the small particles are the powder; the powder is used to develop the image on the xerographic plate.

[1] V. H. Remington, "Some Current Methods of Glass Decorating", *The Glass Industry*, 30, 320 (June, 1949).

[2] Xerography is a generic term for the formation of images by dry electrostatic means. It was derived from the greek words "xeros" (dry) and "graphos" (writing).

[3] For a detailed description of the materials, equipment, and operation of xerography see: R. M. Schaffert and C. D. Oughton, "Xerography: A New Principle of Photography and Graphic Reproduction", *Journal of The Optical Society of America, 38*, 991 (December, 1948); and MacD. Sinclair, "Xerography", *Printing Equipment Engineer, 77*, No. 2, 21 (November, 1948).

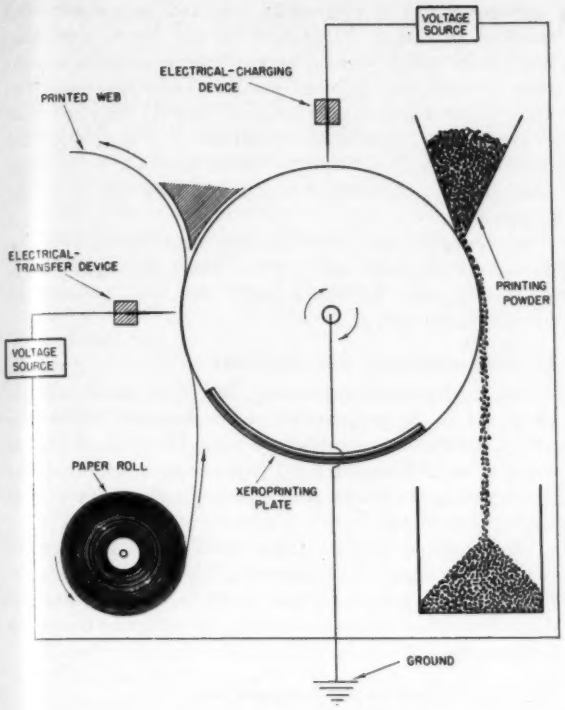


DIAGRAM OF XEROPRINTING MACHINE

Fig. 2. Cross-section drawing of xeroprinting machine; the xeroprinting plate is attached to a cylinder rotating clockwise; the insulating image is charged, dusted, and transferred to a web of paper in a continuous operation.

steps may be summarized as follows: 1) Sensitize xerographic plate; 2) Expose plate to light image; 3) Develop image with decorating powder; and 4) Transfer powder image to article.

The standard xerographic powders used for graphic reproduction on paper consist of low fusing temperature resins. As an overglaze decoration on glass they would not form a permanent image. As an underglaze decoration, the powder would disintegrate during firing. Thus, for glass decoration it has been necessary to formulate xerographic developers using the standard ceramic colors.

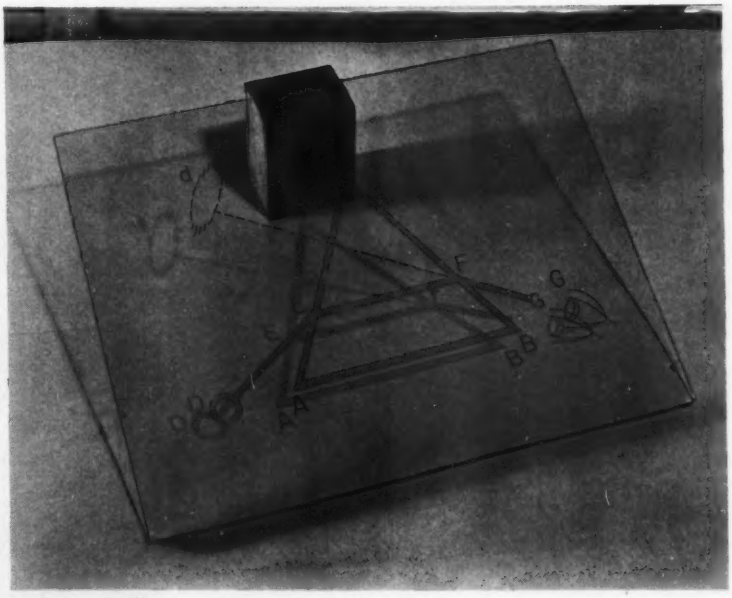
As shown in Figure 1, xerographic developers generally consist of two components—carrier particles and powder particles. The carrier particles serve to generate an electrostatic charge on the powder particles, causing the powder particles to cling to the coarser carrier particles. As a result of this electrical attraction, the carrier sweeps the finer developer across the plate surface. When the powder contacts the electrostatic image area of the plate, it is attracted from the carrier particle to the image. The electrification of the powder and carrier is caused by triboelectricity.[4] The formulation of the proper developer for use on a plate is determined by the relationship of the powder and carrier materials in the triboelectric series. Such a series consists of a list of materials arranged in such a way that each material will acquire a positive electrical charge when contacted or rubbed against any material below it in the list. In general, the magnitude of the electrical charge generated on each of two materials when contacted will depend on the relative positions of the two materials in the series. If the materials are close together in the series, the magnitude of the charge will be small; if the materials are far apart in the series, the magnitude of the charge will be large. Thus, by combining the proper materials, one in the form of a micronized powder and the other in the form of a granular carrier, it is possible to control the magnitude and the sign of the electrostatic charge generated on the powder.

To formulate developers for use in decorating glass, it is necessary to use the above procedure using the standard ceramic colors as the powders. Once a satisfactory carrier is determined for use with the ceramic powder, the two components may be mixed together to form a xerographic developer.

When the ceramic powder consists of only one component, the selection of the proper carrier can be made by finding the position of the powder in the triboelectric series. More often the ceramic powder consists of two or more components. These components may have electrical properties which place them far apart in the triboelectric series. It is then difficult to find a carrier particle which will cause both components to take on the same sign and magnitude of electrostatic charge. In this case it is usually simpler to adjust the triboelectric properties of the powder particles. The two or more components may be combined into one mixture by fusing and then repowdered. Powder prepared from the resulting mixture then acts as a single component powder.

In transferring the powder from a xerographic plate to an article, there must be good contact between both the

Fig. 3. Transfer of xerographic image to a sheet of glass.



[4] For a more detailed discussion on triboelectricity see: F. E. Shaw, "Experiments in Tribo-electricity", *Proc. Roy. Soc., A94*, 16 (1917).
H. F. Richards, "The Contact Electricity of Solid Dielectrics", *Phys. Rev.*, 22, (1923).

Fig. 4. Transfer of xerographic image to a glass container.

plate and the article. Satisfactory contact cannot be obtained if both the plate and article are rigid materials. When transferring an image to a glass surface, it is necessary to use either a flexible xerographic plate or an intermediate transfer medium. Using the intermediate transfer medium, the powder image is first electrostatically transferred to a flexible sheet of paper or plastic. The sheet with the powder image is then placed in contact with the article and the image transferred to the article electrostatically. The flexible sheet provides close contact of the powder image and article which could not be obtained with the rigid xerographic plate. Using the intermediate transfer sheet the images may be prepared and stock piled for later use.

At present only a single color can be printed at one time by xerography. Additional colors can be printed in subsequent operations and the colors can be superimposed. To print several colors on a surface, it is desirable that each image be temporarily tacked to the surface before the next image is applied. This step corresponds to letting the ink dry before applying the next color in the standard decorating processes. The temporary tacking may be done using powder particles which have been coated with a thin layer of a low fusing temperature resin. The resin permits the image to be held in place simply by subjecting the article to a temperature of about 300°F. Permanent fusion at higher temperatures can be made after all the various colors or images have been transferred to the article.

Fig. 5. Transfer of line drawing and continuous tone xerographic images to dinnerware.

Because of the short time required to prepare and transfer an image, xerography should be of particular interest for use in decorating a limited number of articles with the same or different images. Continuous-tone images, signatures or monograms can quickly be transferred to glass sheets, dinnerware, novelties, jewelry and similar items (Figures 3, 4 and 5). Special inscriptions or maps can quickly be placed on ceramic tile for use in public places.

Xerography eliminates the difficulties encountered in the use of "squeegee oil" pastes. The xerographic image is held in place by electrostatic attraction without the use of a tacky paste.

Decalcomania by Xeroprinting

The process of xeroprinting, described above, should be useful in the preparation of decalcomania of similar quality to the screen printed decals. The printed images could be attached to the decal paper using a small amount of thermoplastic binder either on the paper surface or as a coating on the powder.

When using a single color, a continuous web of paper could be xeroprinted (Figure 6). The electrostatic transfer of the image to the article could follow immediately, thus eliminating the need of fixing the image to the paper for later use.

Printing Screens by Xerography

Both steel and silk screen can be prepared by xerography. The screens may then be used in the standard procedures for glass decoration. Xerography offers a fast and simple method of preparing the image on the screen. The standard low fusing temperature resin powders may be used in this application.

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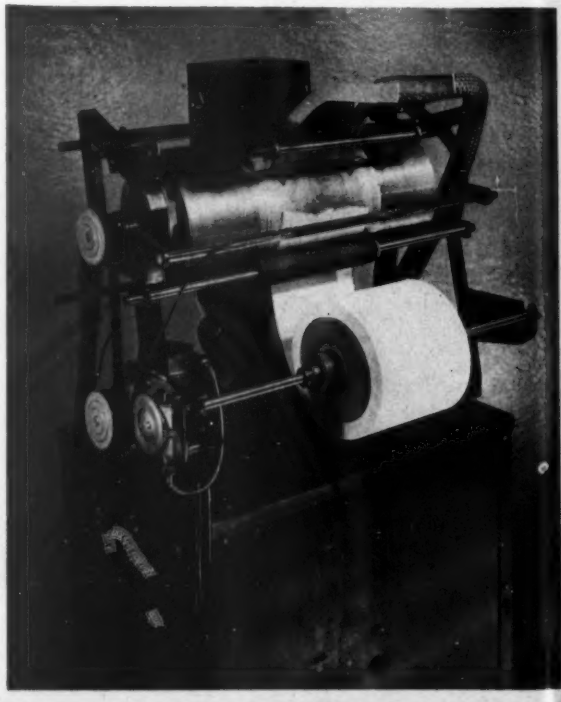

Fig. 6. Laboratory model xeroprinting machine; designed and constructed by Battelle engineers; weighs less than 50 pounds, operates with 1/12 h.p. motor, and prints at speeds up to 1200 web feet per minute.

OPTICAL SOCIETY FALL MEETING

The excellent program of the Optical Society of America which was presented in Buffalo contained a limited number of papers of specific interest to the glass industry. One of these was a paper by M. Herzberger and H. Jenkins on "Color Correction in Optical Systems and Types of Glass". This paper gave a universal dispersion formula which permits the calculation of index of refraction at any wavelength if certain data on relative dispersions are given. The formulae have been tested by experiment and agree to 2 x 10^{-5}. Robert E. Hopkins in "Secondary Color in Optical Relay Systems" showed that secondary spectra can always be reduced but the field curvature may increase in the process.

R. H. Peckham's paper, "Visual Acuity through Various Types and Grades of Sun Glass Lenses", aroused considerable discussion. The writer indicated that there was no difference in visual acuity whether the glasses were made by grinding and polishing, bending polished plate glass, or bending drawn glass. Some opinions disagreed with the method of selecting the lenses for the visual acuity tests.

Those who are interested in color problems will be glad to know that Kasson S. Gibson and Marion A. Belknap, in a paper entitled "The Permanence of Glass Standards Issued to Check the Photometric Scale of Spectrophotometers", stated that N.B.S. glass standards are accurate in chromaticity coordinates to the fourth decimal after sixteen years. They found evidence that the standards will take considerable abuse before showing noticeable change.

E. W. Peterson, H. H. Grossman, J. L. Saunderson and V. J. Caldecourt's "An Electrical Tristimulus Integrator" described an integrator for attachment to the Hardy Spectrophotometer which was simple in construction in comparison to other integrators. Any electronics man might duplicate it without too much trouble. The principle was that of charging a condenser at certain wavelengths, the charge being proportional to the product of the transmission, the energy of the source and the response of the eye. The total charge at the end of the run was found and read. All functions (X, Y, and Z) were obtained at once. D. Nickerson's paper, "Munsell Renotations Used to Study Color Space of Hunter and Adams", related the color spaces of Adams and of Hunter to the Munsell color space.

An interesting feature of this year's meeting was a symposium on microscopy. The invited papers were: "The Optical Microscope as Seen by a Designer" by L. V. Foster of the Bausch and Lomb Optical Co.; "The Optical Microscope as Seen by a User" by Peter Gray of the University of Pittsburgh; "Microscopy Imagery and Interpretations" by H. Osterberg of the American Optical Co.; and "Microspectroscopy" by John Loofbourow of the Massachusetts Institute of Technology.

The paper by L. V. Foster gave a picture of the development of the microscope from the time when each microscope was a handmade instrument through the present methods of making them on a production line basis. The paper of P. Gray dealt with some suggestions for changes in construction as seen by a teacher of microscopy. These included the substitution of a small light source for the mirror, the substitution for the slide clips of a small guide, the use of a 20X eyepiece in place of oil immersion for many beginners in research, and the moving of the slow motion adjustment to a level convenient to the hand as supported on the table. This paper was humorously presented in a spontaneous manner, with slides shown in "rapid fire" fashion. It evoked considerable comment. The paper by H. Osterberg was a presentation of the classical theory of the subject of resolution. The paper of J. Loofbourow dealt with problems encountered in attempting spectrographic studies of single cells from biological specimens.

The session immediately following the symposium on microscopy began with an invited paper by L. Marton of the National Bureau of Standards which was entitled "Electron Microscopy". Although this was not intended to be a continuation of the symposium, it seemed to fit as its extension. L. Marton compared electron and light microscopy. His chief point was that the two methods are not competitive but that they can supplement each other.

Two other invited papers of considerable interest were: "High Precision Measurements with Simple Equipment" by A. C. S. van Heel of the Technical University, Delft, Holland, and "The Eye and the Camera" by George Wald of Harvard University. The first paper discussed the application of very simple optical equipment to various tasks of measuring an alignment. The degree of accuracy attainable with a few inexpensive items such as a source, slit, coarse grating and telescope is much greater than can be obtained by the more usual methods. The second paper was eagerly awaited by the convention which rearranged its program because of a delay in the arrival of the train bearing Dr. Wald. Dr. Wald pointed out that our understanding of the eye has come about from our understanding of the camera. He gave the historical steps in our understanding of the eye and its operation and led up to the recent investigations of the rhodopsin reactions which have been going on at Harvard. To complete his analogy between the eye and the camera, he showed a slide which had been made from a photograph taken on an especially prepared emulsion of rhodopsin in gelatin and which contained no silver compounds.

The dinner meeting proved to be a very enjoyable one. This was the year in which the Frederic Ives Medal was awarded and the recipient was Dr. George R. Harrison. In his address following the award, Dr. Harrison outlined his researches of the past twenty years. He showed how the need for better spectroscopic wavelength data led by a logical series of steps to his present concern with the ruling of very large diffraction gratings and then to the production of a new type of grating which he has named the echelle. Echelles are very coarse gratings of 100 to 500 grooves per inch, the sides of the grooves being perfectly flat, parallel and equally spaced. Theoretically, echelles have many advantages over usual gratings or other means of obtaining high dispersion and resolving power.

Since Dr. Harrison first described the desirable prop-

(*Continued on page* 682)

INVENTIONS AND INVENTORS

A Summary of Recently Issued Patents of Interest to the Glass Industry

Annealing

Corning Tempering Apparatus. Patent No. 2,484,925. (Four sheets of drawings.) This invention by Clyde A. Baker and Ray A. Hinkley was assigned to Corning Glass Works. The apparatus comprises a conveyor passing around two sprocket-like turrets at each end of its path. One of these turrets has a mechanism by which the ware, which has been heated while passing along a straight run of the conveyor, is lifted, tempered by a blast of air and then returned to the conveyor.

The conveyor has a series of ware supports which are rotated at the time the ware is subjected to treatment. A suitable heating kiln surrounds the conveyor as it approaches the cooling section.

The following references are of record in the file of this patent: United States Patents: 1,514,122, Archer, Nov. 4, 1924; 2,375,944, Quentin, May 15, 1945; and 2,377,536, Wisner, June 5, 1945.

Feeding and Forming

Glass Level Indicator. Patent No. 2,483,333. (Three sheets of drawings.) M. M. Cannon Jr., and John S. Light assigned this invention to Hartford-Empire Company.

The invention includes a feeler which is reciprocated vertically into and out of contact with the molten glass in a forehearth. When the feeler detects the glass level, this level is shown on an indicator, recorded on a chart and connections may be made to a batch feeder to automatically vary the feed of batch in accordance with the glass level. The feeler is reciprocated by a reversible motor which may be disconnected to permit the mechanism to be operated by hand.

The following references are of record in the file of this patent: United States Patents: 1,855,757, Harrison, Apr. 26, 1932; 2,032,016, Hitner, Feb. 25, 1936; 2,053,938, Marker, Sept. 8, 1936; and 2,380,436, Holdman, July 31, 1945.

Hartford Double Gob Feeder. Fig. 1. Patent No. 2,485,807. (One sheet of drawings.) This patent relates to the temperature control of the orifice ring used in double gob feeders. Walter K. Berthold and John S. Light assigned the invention to Hartford-Empire Company. This invention is an improvement over Patent No. 2,340,729 to Barker which also relates to temperature control of an orifice ring. This patent to Barker was the only one cited by the Patent Office during the prosecution of this application.

The figure shows a section of a double gob feeder at the orifice. The adjacent sides of the orifices 11 and 12 tend to run too hot so these inventors propose to cool these sides by cooling air from pipes 21 and 22. The remote sides of the orifices are kept hot by Sil-O-Cel insulation. This arrangement keeps the suspended gobs at a uniform temperature all the way around.

Hartford Double Gob Feeder. Fig. 2. Patent No. 2,485,808. (One sheet of drawings.) Walter K. Berthold assigned this invention to Hartford-Empire Company. The object of the invention is to provide means for producing two gobs of equal weight.

The figure shows a section through the orifice of a feeder having a tube, plunger and double outlet orifice ring all of about the usual construction. The rotation of the tube causes an increase in the level of the glass at the outer end of the bowl; that is, at the left in the figure. This tends to produce a heavier gob from the front orifice. This tendency is overcome in this invention by making one orifice slightly larger than the other so that two gobs of equal weight are produced.

The only reference of record in the file of this patent is Patent No. 2,340,729 to Barker.

Hartford Mold Cooling Means. Fig. 3. Patent No. 2,485,836. (One sheet of drawings.) Hugh C. MacConnell, Jr., assigned this invention to Hartford-Empire Company.

The mold and adjacent parts shown in the drawing are of the well-known type, as shown in Patent No. 1,911,119 to Ingle, with some alteration. The mold wall is provided with a series of vertical slots 19, 26 and 27. A manifold 28 receives compressed air from pipes 31, which passes upwardly through the slots, thus cooling different sections of the mold in accordance with the depth of the individual slots.

The following references are of record in the file of this patent: United States Patents: 1,523,021, Ladd, Jan. 13, 1925; 1,531,415, Said, Mar. 31, 1925; 1,632,992, Bragg, June 21, 1927; 1,633,028, La France, June 21, 1927; and 1,685,546, Lee, Sept. 25, 1928.

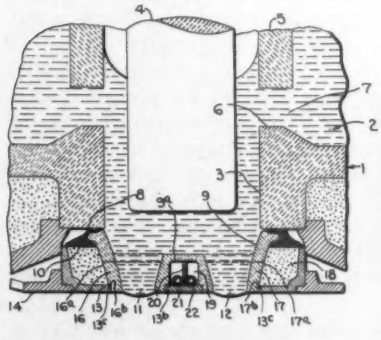

Fig. 1. Hartford Double Gob Feeder.

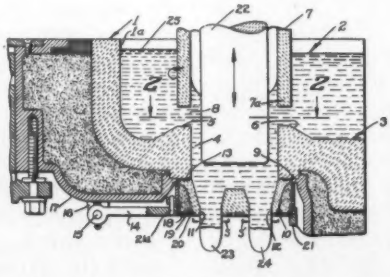

Fig. 2. Hartford Double Gob Feeder.

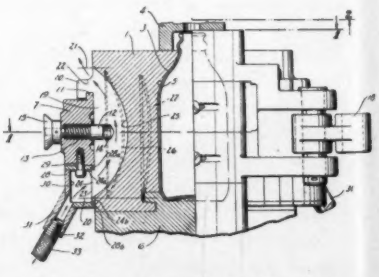

Fig. 3. Hartford Mold Cooling Means.

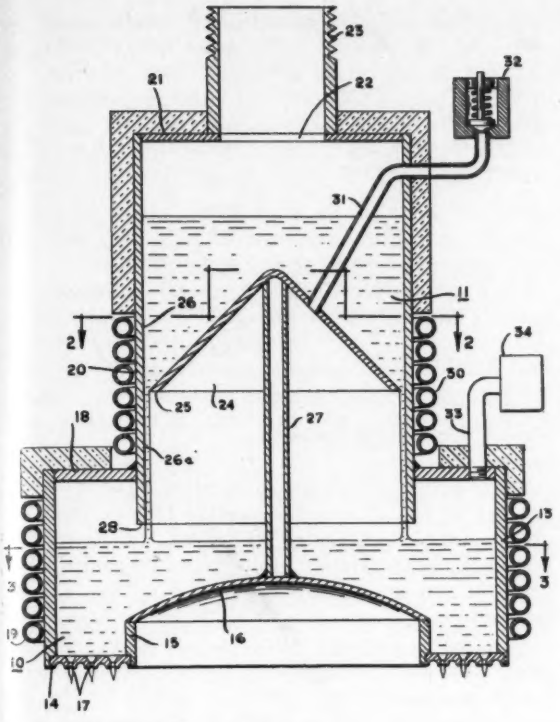

Fig. 4. Electric Melting Furnace.

Glass Compositions

Ceramic Composition. Patent No. 2,486,812. This patent is said to relate to an electrical insulating composition of the porcelain type which includes flint and clay, but all of the six claims are directed to a novel glass composition. The inventor is Woldemar A. Weyl, State College, Pa., who assigned the invention to Monsanto Chemical Company.

Eight examples of this glass composition are as follows although other variations are given in the patent:

No.	Glass Composition	Dielectric Constant
1	$Al(PO_3)_3$ 92%; B_2O_3 8%.....	(low)
2	$Al(PO_3)_3$ 90%; $Mg(PO_3)_2$ 2%; B_2O_3 8%	4.15
3	$Al(PO_3)_3$ 90%; $Ba(PO_3)_2$ 2%; B_2O_3 8%	3.75
4	$Al(PO_3)_3$ 75%; $Ca(PO_3)_2$ 20%; B_2O_3 5%	5.1
5	$Al(PO_3)_3$ 50%; $Mg(PO_3)_2$ 50%.....	5.4
6	$Al(PO_3)_3$ 60%; $Ba(PO_3)_2$ 35%; B_2O_3 5%	5.8
7	SiO_2 (glass) (for comparison).....	3.7
8	SiO_2 (Quartz) (for comparison).....	4.5

Claim 1 defines the invention as a multicomponent metaphosphate glass resulting from the fusing together of from 85% to 98% by weight of $Fe(PO_3)_3$ and from 15% to 2% by weight of fluorspar.

This application was divided from an earlier application filed on Jan. 27, 1941.

The following references are of record in the file of this patent: United States Patents: 1,570,202, Buck, Jan. 19, 1926; 2,194,784, Berger, Mar. 26, 1940; 2,278,501, Tillyer et al., Apr. 7, 1942; and 2,294,844, Gelstharp, Sept. 1, 1942.

Glass Wool and Fiber

Electric Melting Furnace. Fig. 4. Patent No. 2,485,-851. (Three sheets of drawings.) This patent shows a melting furnace and drawing crucible for the manufacture of glass fibers. It is the invention of Charles R. Stevens who assigned it to Glass Fibers, Inc., Waterville, Ohio.

The furnace comprises a drawing chamber 10 having an orifice plate 14 on the bottom, and a melting chamber 11. The drawing chamber is heated by a high frequency coil 19 and the melting chamber is heated by a coil 30. The batch is delivered through an opening 22 which is provided with an air lock so as to maintain a pressure in the melting chamber as supplied by a device 34. An escape valve 32, allows gas to escape from within a deflector 24 over which the molten glass flows to the drawing chamber. This construction causes the extrusion of a multiplicity of fibers from the orifice plate 14.

The following references are of record in the file of this patent: United States Patents: 706,283, Voelker, Aug. 5, 1902; 1,427,014, Von Pazsiczky, Aug. 22, 1922; 1,601,523, George, Sept. 28, 1926; 1,611,328, Arbogast, Dec. 21, 1926; 2,008,495, Ferguson, July 16, 1935; 2,-018,885, Ferguson, Oct. 29, 1935; 2,022,112, Ferguson, Nov. 26, 1935; 2,178,871, Drill, Nov. 7, 1939; 2,187,094; Pink, Jan. 16, 1940; 2,225,667, Staelin, Dec. 24, 1940; 2,227,357, Martin, Dec. 31, 1940; 2,244,267, Slayter et al., June 3, 1941; 2,250,155, Ferguson, July 22, 1941; 2,335,135, Staelin, Nov. 23, 1943; 2,360,373, Tiede, Oct. 17, 1944; and 2,398,952, Nachod, Apr. 23, 1946. Foreign Patents: 354,763, Great Britain, Aug. 10, 1931; 478,334, Great Britain, Apr. 8, 1936; 498,707, Great Britain, Jan. 12, 1939; and 104,379, Sweden, Feb. 26, 1942.

Sheet and Plate Glass

Method of Bending Sheets. Patent No. 2,486,153. (One sheet of drawings.) James D. Gwyn assigned this invention to Libbey-Owens-Ford Glass Company. The method relates particularly to the bending of two sheets which are to be united with a sheet of thermoplastic material interposed between them.

It is usual to bend such sheets in pairs and it is necessary to coat the adjacent surfaces with a parting material so that the sheets will not stick together. This material must not damage the glass and must be readily removable. This inventor has found that sodium sulfate in an anhydrous suspension makes a good parting material. It does not injure the glass and it may be readily removed by washing with water without any scrubbing action.

One example of the material proposed by this patent is as follows: Six pounds of anhydrous sodium sulfate is ground in four pounds of anhydrous methanol, and this suspension of sodium sulfate in methanol is then classified by passing it through a 325 mesh screen. The

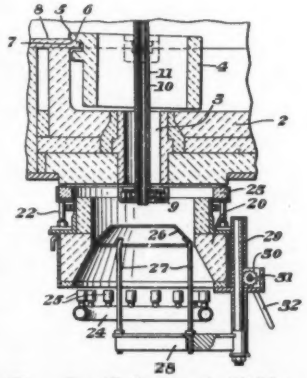

Fig. 5. Method of Making Tube and Cane.

resulting screened suspension is next diluted further with 23 pounds of anhydrous methanol, whereupon it is placed in the container and is ready to be sprayed on the glass. The bending operation and following treatments may be about as usual.

The following references are of record in the file of this patent: United States Patents: 1,328,833, Hasburg, Jan. 27, 1920; 2,079,051, Sullivan, Jr., et al., May 4, 1937; and 2,392,770, Ryan et al., Jan. 8, 1946. "Lange's Handbook of Chemistry," 1934, Table of Physical Constants of Inorganic Compounds, pages 200 and 201, published by Handbook Publishers, Inc., Sandusky, Ohio.

"Practical Methods of Organic Chemistry," 1898, pages 45-49 Gattermann, The Macmillan Co., New York, N. Y.

Tube and Cane Machines

Method of Making Tube and Cane. Fig. 5. Patent No. 2,486,737. (Five sheets of drawings.) This is an invention by Edward Danner. The application was a continuation-in-part of applications resulting in Patents No. 2,462,805; 2,474,302 and 2,390,925.

The figure shows a forehearth 2 having a bottom outlet 3, the upper end of which is surrounded by a distributor 4, which may be raised or lowered by a wedge 8. The glass from the outlet flows to a shaping element 9 carried on the lower end of a blow pipe 10 from which the glass is delivered in a plurality of coaxial streams which join to form a single-walled tube. This tube then enters a shell 20 as described in one of the earlier patents mentioned. Burners 25 are provided to apply heat to the tube as regulated by a vertically adjustable hood 26.

The patent shows several modifications of the invention. The following references are of record in the file of this patent: United States Patents: 2,306,164, Harrison, Dec. 22, 1942. Foreign Patents: 381,582, Great Britain, Sept. 29, 1932 and 750,425, France, May 29, 1933.

Miscellaneous Processes

Glass-to-Metal Seal. Fig. 6. Patent No. 2,482,178. This invention by Robert A. Harris and Charles C. Patton was assigned to Western Electric Company, Inc. The invention relates particularly to uniting copper and glass as used in some types of vacuum tubes.

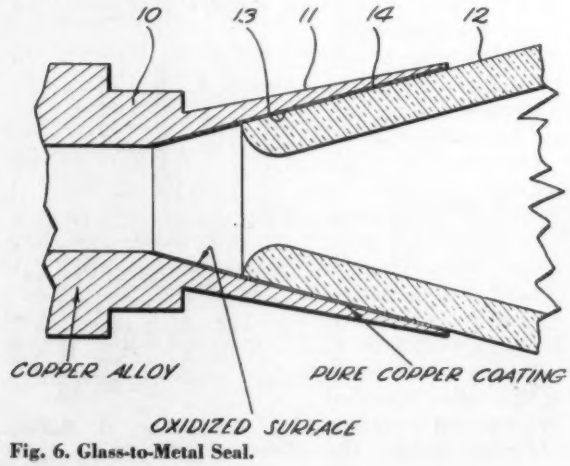

Fig. 6. Glass-to-Metal Seal.

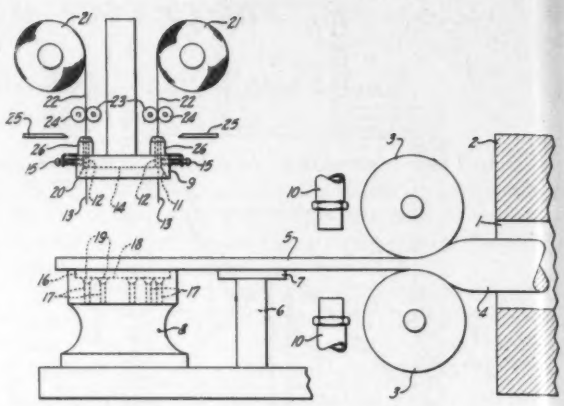

Fig. 7. Stem Making Machine.

The drawing shows a machined tellurium copper alloy member 10 having a hollow portion 11 into which the glass tube 12 is to be sealed. Difficulty is encountered in sealing the glass directly to the tellurium copper alloy which is overcome by electroplating a coating of pure copper 14 on the surface to which the seal is to be made. This surface is then heated until a good oxide coating is formed and then while rotating both parts, the glass is moved into the opening prepared to receive it. The heat required is from 1400 to 1600° F. This forms a satisfactory seal between the parts.

The following references are of record in the file of this patent: United States Patents: 1,350,907, Yanai, Aug. 24, 1920; 1,649,907, Mayer, Nov. 22, 1927; 1,692,998, Ruben, Nov. 27, 1928; 1,980,840, Wright et al., Nov. 13, 1934; 2,010,145, Eitel, Aug. 6, 1935; 2,038,136, Smith, Apr. 21, 1936; 2,167,431, Bowie, July 25, 1939; 2,267,090, Freeman, Dec. 23, 1941; and 2,268,939, Hensel, Jan. 6, 1942.

Stem Making Machine. Fig. 7. Patent No. 2,482,119. This method of making stems for electric lamps is the invention of Erich Mickley, Berlin-Zehlendorf, Germany, and the title to the invention is vested in the Attorney General of the United States. It is noted that the patent expires Oct. 8, 1960. The machine is arranged to punch a glass disc from a ribbon of plastic glass and simultaneously insert and embed the lead-in wires.

In the figure there is shown a heating oven 2 having an opening 1 through which a rod of glass 4 passes to a pair of flattening rolls 3 which forms the glass into a flat band 5 of the desired thickness. The band passes over a stationary die 8 above which there is a vertically movable punch 9. The band may be reheated before reaching the die 8 by burners 10. The lower die 8 is provided with a series of holes 17 which are in vertical alignment with holes 12 in the punch 9.

When the upper punch 9 is lowered, the lead wires 13 penetrate the soft glass and enter the holes 17 in the die 8. When the punch 9 is raised, the clamps 15 which hold the lead wires are released so as to leave the wires in the glass. The lead wires are fed from coils 21 by means of rollers 23 and 24 which may be automatically actuated. Knives 25 cut the wire to the necessary length. While but two lead wires are shown, the number may be increased as desired.

The following references are of record in the file of

this patent: United States Patents: 314,828, Haines, Mar. 31, 1885; 333,028, Stanley, Dec. 22, 1885; 805,963, Jackson, Nov. 28, 1905; 1,770,335, Fuwa, July 8, 1930; 1,831,144, Shearer, Nov. 10, 1931; 2,030,186, Rose, Feb. 11, 1936; 2,114,869, Bol et al., Apr. 19, 1938; and 2,277,150, Scharfnagel, Mar. 24, 1942. Foreign Patents: 720,083, Germany, Apr. 23, 1942.

General Electric Tipping-off Burner. Fig. 8. Patent No. 2,482,400. This invention is useful in the manufacture of electric lamps or similar evacuated devices where an exhaust tube has to be sealed and removed from the bulb. It is the invention of Paul O. Cartun who assigned it to General Electric Company.

The device comprises a pair of pincers 1 having arms 2 and 3 pivoted at 4, shears 5 and 6 being mounted near the ends of the arms 2. A ring burner 9 is mounted on the pivot 4 and positioned so that a ring of flame occurs just below the shears 5 and 6 as viewed in the upper part of the figure. Gas for the burner is supplied through a pipe 11.

The lower part of the figure shows a lamp 13 having a base 14 and an exhaust tube 15. As soon as the tube has been softened by the burner, the tube collapses under atmospheric pressure after which the shears are closed to complete the closure of the tube and to cut it off.

The following references are of record in the file of this patent: United States Patents: 1,083,386, Chapman, Jan. 6, 1914; 1,346,528, Brown, July 13, 1920; 1,422,826, Brown, July 18, 1922; 1,456,639, Lagier, May 29, 1923; 1,457,491, Beebe, June 5, 1923; and 2,032,688, Dart, Mar. 3, 1936.

Flat Tube Fluorescent Lamp. Fig. 9. Patent No. 2,482,421. This invention was assigned to General Electric Company by Eugene Lemmers of Cleveland Heights, Ohio. It is well-known that for certain purposes an oval or flat tube for fluorescent lamps is much more desirable, but heretofore so many difficulties have been encountered in their manufacture that the only one sold commercially was known as the "T2½ X 6" which was only 6 to 9 inches long. This inventor has discovered a method of making flat tubes, which are not limited to the small size mentioned.

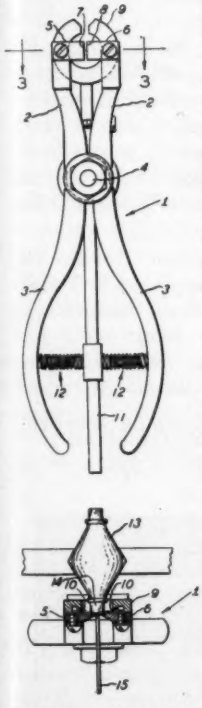

Fig. 8. General Electric Tipping-off Burner.

As shown in Fig. 9, the tube has round ends 10, 10 and the usual electrical connections. An exhaust tube is provided at 18 and the tube is coated on the inside with the usual luminescent material, all as is usual. The tube is flattened by apparatus indicated at F comprising iron bars 30, 30 shaped to correspond with the desired shape of the tube and guided for parallel movement toward and from each other by pins 33. The bars are covered with asbestos tape 35 and they are heated by electrical strip heaters 37.

When the bars 30 and the tube have been heated, the parts are placed in the position shown in the lower part

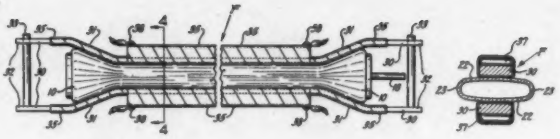

Fig. 9. Flat Tube Fluorescent Lamp.

of the figure so that the weight of the upper bar 30 flattens the tube. The heat is controlled so that the edges 23 keep close to the temperature of the walls 22 and reach a temperature below the strain point at about the same time. This process results in a flattened tube in which the glass is in a state of surface compression only along the longitudinal edges.

The following references are of record in the file of this patent: United States Patents: 1,016,320, Burnside, Feb. 6, 1912; 1,483,461, Littleton, Jr., Feb. 12, 1924; 1,981,560, Littleton, Nov. 20, 1934; 1,994,312, Herre, Mar. 12, 1935; 2,001,852, Romer, May 21, 1935; 2,055,981, Magnien, Sept. 29, 1936; 2,062,836, Scott, Dec. 1, 1936; and 2,244,715, Long, June 10, 1941. Foreign Patents: 486,325, Great Britain, June 2, 1938.

Glass-to-Metal Seal. Fig. 10. Patent No. 2,482,494. This invention was assigned to Westinghouse Electric Corporation by William J. Knochel and Jens J. Aakjer of East Orange, N. J. In a prior patent issued on the application of Howard Scott, No. 2,062,335, a method of making glass-to-metal seals is described in which it was necessary that the time intervening between the cleaning and baking of the alloy steel and the final glassing operation be definitely limited. This invention makes a good seal regardless of the length of time between these operations.

The legends on the drawings make the method almost self-explanatory. In the manufacture of the vacuum vessel of a mercury arc discharge tube, a header 4 includes a metal tube 11 and a glass tube 10. The metal tube 11 is secured to the header 4 in the usual manner and then the header is placed in the chuck 15 of a glassing lathe and the metal sleeve 10 is placed in the tail chuck 17. The chucks are then rotated and the reducing flame of one or more oxygen and hydrogen burners 19 is directed onto the metal tube for about five minutes at a temperature of from 850 to 930°C. The sleeve is then allowed to cool, is polished and cleaned.

For the final operation, both the parts 10 and 11 are heated to the fusion temperature of the glass by burners

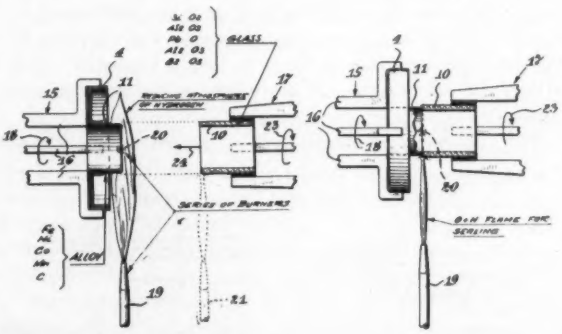

Fig. 10. Glass-to-Metal Seal.

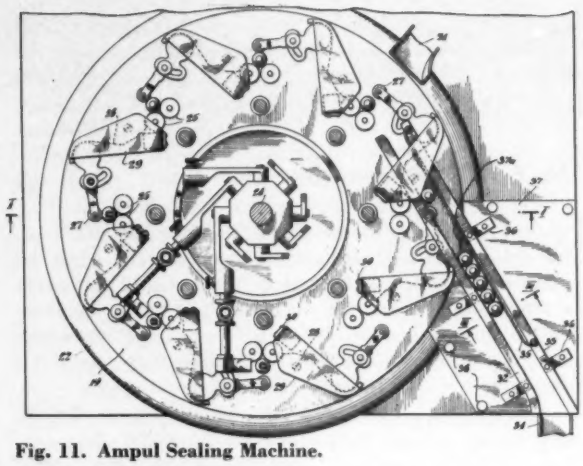

Fig. 11. Ampul Sealing Machine.

19 and 21. The head chuck 15 and the tail chuck 17 are then moved together and the burner 19 is kept on until the sealing operation is complete. The metal sleeve thus treated can be used at any time after treatment without danger of faulty seals.

The following references are of record in the file of this patent: United States Patents: 1,740,443, Donat, Dec. 24, 1929; 1,884,665, Greiner, Oct. 25, 1932; 2,006,568, Gustin et al., July 2, 1935; 2,043,307, Scott, June 9, 1936; 2,062,335, Scott, Dec. 1, 1936; 2,167,431, Bowie, July 25, 1939; 2,238,599, Ramage, Apr. 15, 1941; and 2,279,168, Kalischer et al., Apr. 7, 1942.

Ampul Sealing Machine. Fig. 11. Patent No. 2,482,969. This invention was assigned to Winthrop-Stearns, Inc., of New York City by Harold R. Fry, Jr., of Troy, N. Y. It is said to be an improvement over the machine shown in the Cozzoli Patent No. 2,258,408. The invention saves a lot of ampuls which were formerly damaged after sealing.

The figure shows a sectional plan of the machine omitting the sealing mechanism which is or may be in accordance with the Cozzoli patent. The machine comprises a turntable 19 having a central shaft 24 which carries the burners, grippers and pressure connections. The table also carries eight pairs of rolls 25 and the ampul is held against these rolls and driven thereby by pressure rolls 27. Cam plates 28 and 29 are mounted on the table and each has an edge adapted to engage and shape the ampul which has previously been heated. The removed portions of the ampul are dropped into a chute 31.

The finished ampuls are delivered to guides 32 and 33 by the cams 28 and 29 where they are positioned by a wire spring 35. From this they may be removed by the operator or allowed to drop into a chute 34. This allows the ampuls to cool so that they are not liable to damage.

The following references are of record in the file of this patent: United States Patents: 1,290,055, Biggs, Jan. 7, 1919; 1,455,037, Belden, May 15, 1923; 1,777,654, Saviano, Oct. 7, 1930; 1,981,641, Benoit, Nov. 20, 1934; 2,168,509, Bennett, Aug. 8, 1939; and 2,258,408, Cozzoli, Oct. 7, 1941.

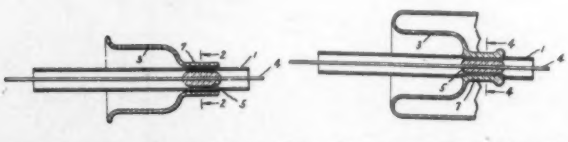

Fig. 12. Lead-in Seals for Ultra-high Frequency Electric Discharge Devices.

Lead-in Seals for Ultra-high Frequency Electric Discharge Devices. Fig. 12. Patent No. 2,483,940. This invention by William J. Scott, Ruby, England, was assigned to General Electric Company.

The upper part of the figure shows the parts as they appear before the sealing operation and the lower part shows the parts after sealing. An outer hollow conductor 1 is inside the opening of a glass body 3 and it surrounds a solid conductor 4 which may have a glass bead 5 previously secured to it. These parts are assembled in a suitable jig after which heat is applied to soften the glass parts. Pressure is then applied sufficient to flatten the hollow conductor 1 and to seal the parts together.

The patent gives modifications of the invention with full directions for its use,

The following references are of record in the file of this patent: United States Patents: 1,271,245, Von Recklinghausen, July 2, 1918; 1,359,134, Wetmore, Nov. 16, 1920; 1,456,110, Mackay, May 22, 1923; 1,489,099, Reynolds, Apr. 1, 1924; 1,680,738, Hull, Aug. 14, 1928; 2,030,185, Rose, Feb. 11, 1936; 2,057,305, Lyle, Oct. 13, 1936; 2,162,489, Matthies et al., June 13, 1939; 2,173,473, Edwards, Sept. 19, 1939; 2,190,302, Waldschmidt, Feb. 13, 1940; 2,197,511, Scharfnagel, Apr. 16, 1940; 2,220,742, Thorson, Nov. 5, 1940; 2,279,818, Freeman, Apr. 14, 1942; 2,394,398, Mouromtseff et al., Feb. 5, 1946; and 2,414,785, Harrison et al., Jan. 21, 1947.

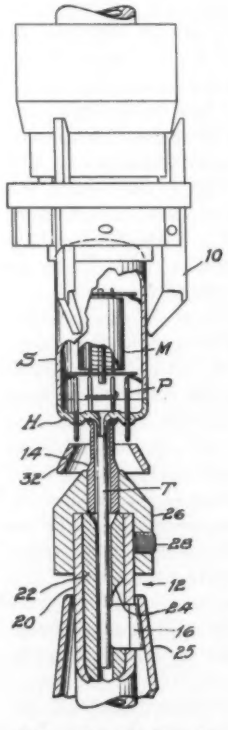

Fig. 13. Sealing-in Machine.

Sealing-in Machine. Fig. 13. Patent No. 2,484,688. Clayton R. Cowley made this invention and assigned it to Sylvania Electric Products, Inc. The invention relates to the manufacture of radio tubes and the like.

This invention is an improvement on what is known as the "Sealex" machine. In the figure there is shown a shell S, a header H which carries the mount M, metal

(*Continued on page* 678)

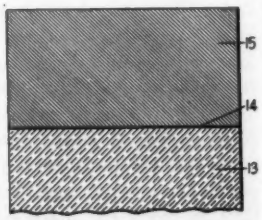

Fig. 14. Mirror Structure.

Research Digest

Study of Adherence of Molten Glass to Heated Metals

The problem of the adherence of molten glass to heated metals is of great importance in mechanical glass fabrication processes, particularly in the automatic forming of glass containers. Very little information on this phase of glass technology appears in the literature. Such information would be of extreme value to the practical man who is interested in knowing what metals to select or what metal treatment to use for certain operations, for example, plungers in the press and blow process. In an effort to supply this data, Kapnicky, Fairbanks and Koehler (*Journal of the American Ceramic Society*, October 1949) have made a laboratory study of the problem.

A simulative test was devised to give comparative results in terms of metal temperatures. The procedure, in brief, was as follows: drops of molten glass, the temperature of which was determined by an optical pyrometer, were allowed to drop on the inclined surface of the metal being tested, the temperature of the latter being gradually raised until the glass drops showed a tendency to stick instead of rolling off. Observations were made both on rising metal temperatures and decreasing metal temperatures and the "critical temperature" was determined.

Critical temperatures were determined for various nonferrous metals, ferrous metals and for ferrous metals which were given surface treatments, such as cyaniding, carburizing, nitriding, quenching and annealing. In addition, the effect of surface roughness and various mold lubricants on the critical temperature was investigated.

From the results of these tests, it was concluded that 1) the highest critical temperature obtained was 650°F. for the stainless steels tested and for pure aluminum. The cast irons tested generally had critical temperatures at 600° ± 25°F.; no relationship between critical temperature and the carbon and silicon content was apparent. The lowest critical temperatures were of the order of 500°F. These were obtained for a chromium-nickel-tungsten alloy and for pure titanium.

2) The various treatments used on the metals, with the exception of the lubricants mentioned under paragraph 4 below, lowered the critical temperatures. The average lowering of the values for the treatments was 78°F. for carburizing, 100°F. for cyaniding, 113°F. for nitriding, 142°F. for annealing and 100°F. for quenching.

3) An increase in degree of polish of the metal surface raised the critical temperatures from an average of 425°F. to an average of 625°F. for the samples polished on No. 1 and 3/0 paper, respectively.

4) All the mold lubricants evaluated raised the critical temperature. An increase of 200°F. was obtained by applying a graphite suspension in oil. In this case, the critical temperature was found to depend somewhat on the time between application of the lubricant and the falling of the glass drop.

The Routine Control by Density and Thermal Expansion Measurements of Glasses During Manufacture

One of the major physical properties of importance in glasses for lamps and radio tubes is the thermal expansion coefficient. In some cases the specification demands a close tolerance for this coefficient, and there is the danger that production may be delayed until the result of a control test itself is known if one depends entirely upon the conventional slow methods of test. Density determinations, however, may be carried out with both speed and accuracy. Staton and Maycock (*Journal of the Society of Glass Technology*, June 1949) report on a survey of work which has been done with the object of providing rapid determinations of the thermal expansion coefficient and, where possible, a correlation of this coefficient with the glass density.

Using the well-known differential-to-silica relationship, an apparatus was developed which allowed the thermal expansion measurement to be made by a "rapid" method. As standardized annealing cycles of short duration are essential to the success of this thermal expansion test, a method for rapid annealing of the specimens was also developed. It was found that the results obtained by the rapid testing procedure differ from those obtained by the standard procedure. The practice adopted was to apply a mathematical correction to the results obtained by the rapid method in order that all figures reported shall refer to the standard scale. It was emphasized that a uniform sampling technique is essential to the success of the thermal expansion measurement. Rods should be drawn from one gathering of glass so that when viewed end on in polarized light no sign of "core" is visible in the sample. The presence of layering is fatal and precludes any attempt at eradication of strain. Similar remarks apply to stones, cords or striae.

The laboratory density determinations are carried out at 20°C. by the Cerchimedes method using slabs of seed-free glass ¼ inch thick from which a sample weighing 2-6gm. is taken for test. Unannealed specimens are used since preliminary investigation showed that with standardized sampling, a constant difference is obtained between the densities of annealed and unannealed samples. In the case of pot-melted glasses, a "sink-float" apparatus for determining density is used in the factory so that any pot of glass may be tested and a decision rapidly made by the foreman as to whether the pot of glass should be accepted for production.

Many types of glass have been examined for the relationship between density and linear thermal expansion and it was found that in most cases this relationship can be a rapid means of predicting the expansion coefficient through the medium of density. To a more limited extent, it is possible to obtain correlation between density, thermal expansion and the results of chemical analysis.

The normal laboratory control procedure for special glasses, which are usually pot melted, is to prepare ¼

(*Continued on page* 683)

FEDERAL GLASS OPENS NEW PLANT CAFETERIA

One of the country's most modern industrial employees food service was recently opened at the plant of The Federal Glass Company in Columbus, Ohio. Located in a building built expressly for it, the new cafeteria is operated by Crotty Brothers, a national industrial food service organization. Planned to meet the problems raised by Federal's continuous operation, the new cafeteria embodies the latest developments in equipment and methods for in-plant feeding geared to the need for a 24-hour meal service.

The food service area combines attractive surroundings with utility of operation. The walls are of cream colored tile to the ceiling, with terrazzo floors and fluorescent lighting. Stainless steel and chrome fixtures are used throughout the cafeteria serving line.

In addition to the regular cafeteria meal items, a short order table and grill provides sandwiches and other short order items. A large variety of pastry items, baked daily in the cafeteria kitchen, are always available. All vegetables and fruit served are fresh or frozen. A large walk-in cooler equipped with meat racks makes possible the purchase of meat in large cuts.

Electronically controlled dishwashing equipment, plus modern detergents, keep the cafeteria glass tableware and tumblers sparkling.

GRADUATE STUDY OF GLASS AND CERAMICS AT M. I. T.

The opening of the fall term finds twelve men enrolled in graduate study programs in the Ceramics Division at M. I. T. Seven of these are new students while the remainder are completing programs already under way. The new men offer a variety of interesting backgrounds on which to build graduate work in ceramic technology, in fact no two are alike. Milton Adams has a B.S. degree in Chemical Engineering from the University of Toledo and an M.S. degree in Glass Technology, also from Toledo. Herbert H. Anderson received a B.S. in Ceramic Technology from Alfred University. Morris Berg is a graduate in Ceramic Engineering from Ohio State University with several years' industrial experience as a ceramic engineer for A C Spark Plug Co. Charles P. Fullerton is a recent graduate in Chemical Engineering from the University of Colorado. George Economos is a chemist, and graduate of Northeastern University. Michael Humenik has a B.S. degree in Glass Technology from Alfred University. Malcolm McQuarrie is a physicist with a B.S. in Engineering Physics from Lehigh University and an M.S. in physics from California Institute of Technology. All of these men have been appointed to research assistantships in the Ceramics Division.

The twelve graduate students in Ceramics are joined by several graduate students from other departments who are minoring in ceramics. Two geologists and one metallurgist compose this group, with one of the geologists planning a thesis in clay mineral technology in this Division. Two seniors, one from Chemical Engineering and one from Business and Engineering Administration, are doing their senior research problems in ceramics this year. Two men have been added to the laboratory staff as technicians in addition to the one who has been here in the past. Since June, two men have completed their programs and received the degree of Doctor of Science in Ceramics. Dr. James A. Stavrolakis presented a thesis entitled "Shear Properties of Refractory Oxides" and has joined the staff of Fairchild Aviation Laboratories at Oak Ridge. Dr. Walter H. East completed his investigation of "Water Films in Monodispersed Kaolinite Fractions" and is remaining for the present at the Massachusetts Institute of Technology as an instructor in the Department of Mechanical Engineering Heat Measurements Laboratory.

New equipment added to the laboratory includes a 10 kilowatt TOCCO induction generator to provide a second source of 10 kilocycle power for induction heating in addition to the 50 kilowatt machine already in use. Two new induction furnace assemblies for studies at 2000°C and over are being built. One is an inert atmosphere or vacuum furnace for the study of metallic-ceramic surface phenomena, while the other is designed for the study of thermal conductivities of ceramic materials at high temperatures. Three Leeds and Northrup optical pyrometers and an L & N Speedomax stripchart recorder have also been purchased in addition to a miscellany of lesser items, such as vacuum tube volt meter circuit testers, voltage regulators, etc. Progress is continuing on the electron microscope being installed in the laboratory. The design incorporates the better features of the RCA and Phillips instruments, having an electron optic system of three large lenses and a 100,000 volt supply. Operation of this instrument is anticipated for January and it is believed that practical resolution will be achieved of the order of 30 to 40 Angstrom units.

The Ceramics Division at M. I. T. now occupies six large laboratories in addition to office space and with the facilities now available, the twelve to fifteen graduate students are provided with an unusually high investment per student ratio for the conduction of graduate study and research in ceramics as well as extensive opportunities for study elsewhere in the Institute in other fields applicable to ceramic technology.

• Faustin J. Solon, Vice President of Owens-Illinois Glass Company, has succeeded Don Belding of Foote, Cone and Belding as Chairman of the joint ANA-AAAA American economic system committee. Mr. Solon has been a member of the committee since its inception.

CURRENT STATISTICAL POSITION OF GLASS

Employment and payrolls: Employment during the month of September 1949 was reported to be 107,100. This represents only a slight increase over the previous month's revised employment figure of 106,700 persons.

Payrolls for the month of September 1949 were $26,008,164. This is slightly higher than the revised $25,927,523 paid out by glass manufacturers during August 1949.

Glass container production, based on figures released by the Bureau of Census, showed an increase for October 1949 and was reported at 8,283,420 gross. This is 9½ per cent above September's 7,550,490 gross. During October 1948, production was 9,107,323 gross, which is 9 per cent more than for October this year. Total glass container production at the close of the January-October 1949 periods, has reached 76,416,861 gross, as compared with 84,685,337 gross produced during the corresponding period in 1948—a difference of 9½ per cent.

Shipments of glass containers during October 1949 fell off 2½ per cent from the previous month's 8,156,030 gross to reach 7,945,312 gross. During October 1948, shipments were 8,457,337 gross, or 5 per cent above October this year. Total glass container shipments at the close of the 10-month period ending October 1949 have reached 75,947,018 gross. At the close of the same period in 1948, shipments were about 9½ per cent above this figure, or 84,195,107 gross.

Stocks on hand at the close of October 1949 were 8,601,979 gross. During September, stocks were 8,318,335 gross and at the close of October 1948, stocks were 7,794,565 gross.

GLASS CONTAINER SHIPMENTS

(All figures in Gross)

	October 1949
Narrow Neck Containers	
Foods	759,885
Medicinal & Health Supplies	1,080,910
Chemicals, Household & Industrial	543,678
Beverages, Returnable	163,376
Beverages, Non-returnable	1,060
Beer, Returnable	119,166
Beer, Non-returnable	179,235
Liquors	934,246
Wines	424,972
Toiletries & Cosmetics	538,815
Sub-total (Narrow)	4,745,343
Wide Mouth Containers	
Foods	2,048,585
Dairy Products	308,375
Home Canning	*14,619
Medicinal & Health Supplies	271,917
Chemicals, Household & Industrial	108,219
Toiletries & Cosmetics	132,169
Packers' Tumblers	108,045
Sub-total (Wide)	2,991,929
Total Domestic	7,737,272
Export Shipments	208,040
Total Shipments	7,945,312

* This figure represents Fruit Jars only.

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in Gross)

		Production October 1949	Stocks October 1949
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	3,096,652	2,981,520
	Wide Mouth	*2,588,956	2,273,172
Dairy Products		343,726	254,325
Home Canning			398,507
Beverages, Returnable		254,881	672,334
Beverages, Non-returnable			10,939
Beer, Returnable		142,611	586,501
Beer, Non-returnable		184,970	301,954
Liquors		1,089,367	724,940
Wines		470,950	290,530
Packers' Tumblers		111,267	107,257
Total		8,283,420	8,601,979

* This figure includes Fruit Jars.

Automatic tumbler production for the month of September 1949 was 4,769,645 dozens. This is close to 3 per cent below August's 4,907,180 dozens. During September 1948, production was 4,635,814 dozens. Shipments for the month of September rose slightly more than 1 per cent to reach 4,734,449 dozens. This is an increase over the 4,676,099 dozens shipped during August. During September 1948, shipments were 5,038,378 dozens. Stocks on hand at the close of September 1949 were 7,618,221 dozens, as compared with 7,714,855 dozens on hand at the close of August 1949 and 6,987,412 dozens on hand at the close of August 1948.

During the month of October 1949, automatic tumbler production rose about 15½ per cent to reach 5,521,215 dozens. This is an increase over the previous month's 4,769,645. During October 1948, production was 5,851,555 dozens. Shipments during October 1949 were 5,436,365 dozens which represents an increase of close to 16 per cent over September's shipments of 4,734,449 dozens. During October 1948, shipments were 5,428,811 dozens. Stocks on hand at the close of October were 7,676,420 dozens, as compared with 7,618,221 dozens on hand at the close of September and 7,150,161 dozens on hand at the close of October 1948.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware varied only slightly from August's 3,322,951 dozens to reach 3,349,273 dozens for the month of September 1949. During September 1948, sales were reported at 3,401,822 dozens. At the close of the 12-month period ending September 1949, manufacturers' sales have reached a total of 39,503,908 dozens. This is close to 1 per cent less than the 42,849,121 dozens sold during the corresponding period in 1948.

Manufacturers' sales for October 1949 were 3,801,002 dozens, representing close to 13½ per cent above September's 3,349,273 dozens. Sales during October 1948 were 4,300,699 dozens. At the close of the 12-month period ending October 1949, total manufacturers' sales had reached 39,004,211 dozens which is 9 per cent less than the 42,639,111 dozens sold during the corresponding period in 1948.

Left to right: Drs. Hostetter, Peiler, McGrath and Dean of Education Joseph Seidlin.

KARL E. PEILER RECEIVES HONORARY DEGREE AT ALFRED

On the occasion of the 114th Founders' Day at Alfred University, Dr. M. Ellis Drake was inaugurated as the 9th President of the University and Dr. Earl J. McGrath, United States Commissioner of Education, gave the principal address. President Drake was inducted into office by Dr. William C. Cannon of New York, Chairman of the Board of Trustees. Dr. Cannon gave President Drake as a token of his office a mace designed as a modern replica of the jewel of King Alfred. Traditionally, this jewel was a large amethyst. It is now represented by a piece of purple glass colored by neodymium, made in the glass laboratory at the College of Ceramics at the time of the Centennial celebration in 1936. It is enclosed in a gilt filigree fashioned by a former instructor in jewelry.

Of particular interest to glass men was the conferring of the honorary degree of Doctor of Engineering upon Karl E. Peiler of the Hartford-Empire Company, renowned inventor of glass-feeding and glass-forming and handling equipment. Dr. Peiler was presented for the degree by Dr. John C. Hostetter, Mississippi Glass Company, a member of the Board of Managers of the College of Ceramics. The citation follows:

"Mr. President: On this auspicious occasion, we are honored by the presence of an Engineer and Inventor whose name and accomplishments are known throughout the world wherever glass is made. Graduate of the Massachusetts Institute of Technology, our guest has invented many revolutionary machines and processes for manipulating and forming molten glass into such useful and diverse articles as containers, dishes, lamp bulbs, and tubing. His numerous inventions have resulted in several hundred patents, here and abroad. For his distinguished achievements in science and invention, he received in 1940 an award as a Modern Pioneer on the Frontier of American Industry. He is a Fellow of the American Ceramic Society.

Mr. President, I am happy to present Karl Ernest Peiler for the Honorary Degree of Doctor of Engineering."

Dr. Peiler received a rousing ovation from the student audience, which included many who recognized and appreciated his achievements. Although he was restrained from doing so by the dignity of the occasion, Dr. Hostetter, in view of Karl Peiler's well-known propensities, would like to have used something like the following:

"I give you inventor Karl Peiler:
Of many a patent the feiler;
Glass-works expediter,
Great limerick writer;
Conversational wit and begeiler."

Among those attending the convocation were James Bailey and Sidney Parham of Hartford-Empire Company and J. T. Littleton and W. C. Taylor of Corning Glass Works.

OWENS-CORNING NAMED IN COURT SUIT

The Glasfloss Corporation of Stratford, Conn., and with a manufacturing plant in Hicksville, New York, has brought a $9,000,000 anti-trust suit against Owens-Corning Fiberglas Corporation. Also named as defendants are two parent companies of the firm: Owens-Illinois Glass Company and Corning Glass Works.

The Glasfloss Corporation charges the defendants with monopoly, attempted monoply, international cartel, combination, conspiracy and restraint of trade. The suit claims that Harold Boeschenstein, President of the Fiberglas firm, while serving as deputy vice chairman of the War Production Board during the war, "took steps to defeat" a project for expansion of Glasfloss plant facilities. The purpose of the expansion was to produce glass fiber parts to replace rubber parts in batteries for the army, the complaint said.

Glasfloss said its expansion project finally went through despite Mr. Boeschenstein's alleged effort to stop it, but that his actions caused delays and financial loss. The complaint also accused Fiberglas of using price cuts, discounts, intercorporate agreements and contracts to purchase which violated federal anti-trust laws, common law and New York state law.

H. W. PRENTIS ELECTED PRESIDENT OF WILSON COLLEGE

H. W. Prentis, Jr., President of the Armstrong Cork Company, has been elected President of the Wilson College board of trustees. He succeeds the Rev. Dr. John B. Laird, board President since 1920.

Associated with the Armstrong firm for more than forty years, Mr. Prentis is a Director of the Mellon National Bank and Trust Company.

CORRECTION: Due to a typographical error, the molecular composition of the sodium silicate liquid which is formed on the hot face of silica refractories in the melting end of glass furnaces was incorrectly given on Page 522 of the September issue of THE GLASS INDUSTRY. As observed by Insley and reported in the paper entitled "Bonded Refractories for Special Purposes" by R. W. Knauft, the formula for this product is $Na_2O\ Al_2O_3\ 5\ SiO_2$. We suggest that anyone who has retained this particular paper for reference make this correction in their copy.

NEW EQUIPMENT AND SUPPLIES

GAS TEMPERATURE INDICATOR

Fairchild Camera & Instrument Corporation, Pasadena, California, has announced the development of a new remote reading ultra high gas temperature indicator which provides a convenient and accurate method for measuring gas temperatures to more than 5,000°F.

The operating principle of this new indicator, designated Fairchild Model 263 Gas Temperature Indicator, is based upon well established equations for gas flow through a metering orifice, according to the firm's report. In operation, a small sample of the gases is obtained by means of a water cooled stainless steel probe. The probe may be manipulated to obtain a temperature traverse of the gas stream under test.

The gas sample is immediately passed through a small iridium orifice, cooled and passed through a second metering orifice and manually operated pressure reducing valve to atmosphere. By adjustment, the differential pressure drop across the iridium orifice will be a linear function of the absolute temperature of the gases being measured. A differential pressure gage connected across the iridium orifice then indicates the temperature of the gases.

PORTABLE WATER BATH

Fisher Scientific Company, 717 Forbes Street, Pittsburgh 19, Pa., has announced a new portable water bath weighing only 24 pounds and featuring a device which prevents it from going dry. The bath accommodates a wide variety of laboratory glassware and incorporates integral rod-and-clamp arrangement.

The water bath, 15″ in diameter by 7″ high, has a Monel exterior and tinned copper interior for resistance to corrosion. It employs two immersion type heaters, either or both of which can be used for low or high heat.

Concentric rings conveniently marked for various sizes of flasks are provided, as well as a test tube holder which accommodates up to fourteen tubes. A special bottle-feed device prevents the bath from boiling dry for as long as ten hours on low heat and four to five hours on high heat.

NEW SAFETY SHUTOFF VALVE

North American Manufacturing Company, 4455 East 71st Street, Cleveland 5, Ohio, has recently added to its production line a new Associated Factory Mutual Approved valve known as the Series 21 Safety Shutoff Valve.

Designed for the protection of industrial furnaces against dangerous accumulations of gaseous or liquid fuels in the event of a power failure, this valve stops the flow of any gas or liquid instantly when the current to its solenoid is interrupted. When the power is restored, the valve remains closed until the trouble is corrected, at which time the valve is reset manually.

Any number of switches wired in series with the solenoid can protect the installation against explosion hazards resulting from failure of air pressure, gas or oil pressure, etc., in addition to general power failure, or the valve may be tripped closed manually if desired. It cannot be wedged or propped open with power off since the resetting handle is independent of the valve stem.

CATALOGUES RECEIVED

Willson Products, Inc., Reading, Pa., has issued a new industrial safety equipment catalogue. In addition to providing product information in the company's line of eye and respiratory equipment, the 64-page booklet contains technical and reference material. This has been included to help the user select the proper type and style of equipment for the specific occupational hazard involved and to give him information on its use and care.

Among the subjects discussed are a digest of U. S. Federal Specifications for heat-treated glass and tests made to insure conformance and performance; types of filter glass available for use in occupations where varying degrees of glare and radiant energy are encountered; discussion of types of respiratory hazards, what respirators to use for specific hazards and care and maintenance of respirators; gas mask selector tables showing gases and vapors prevalent in industry.

Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Pa., has announced a new bulletin, "Optical Pyrometer—Potentiometer Type."

Two special lens assemblies are described in this bulletin which shows how the lenses are helping operators to make easier, faster temperature readings of thin or small-area objects. In addition, the catalogue shows the easy interchangeability of these special lenses with the standard one used for usual measurements.

Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio, is distributing a new, 16-page booklet describing eight major groups of chemical products and depicting their diverse utilization throughout American industry.

The booklet reviews soda ash, caustic soda, chlorine, bicarbonate of soda, silicates, calcium carbonates, chromates and specialty chemicals, pointing up the economic significance of each.

Posey Iron Works, Inc., Lancaster, Pa., has issued a bulletin devoted to Posey plants and the various divisions of the company.

The booklet briefly reviews the facilities of the firm and illustrates sections of the Steel Plate Division, Machine Shop, Brick Machinery Division, The Foundry, Industrial Heating Division, Steel Form Division, Iroquois Division and the Shipbuilding Division. Many of the products produced by these various divisions of the company are illustrated and descriptions and some installations are given.

Bailey Meter Company, Cleveland 10, Ohio, is distributing a new bulletin, 150-A, devoted to the Bailey Combustible Recorder.

The 16-page booklet includes drawings and photographs which explain the operation of this electronic type instrument which operates on the catalytic combustion principle. Typical applications to boiler furnaces, atmosphere producers, rotary kilns, industrial furnaces and chemical processes are illustrated.

Either air or electrically-operated control of combustibles content may be had with the combustibles recorder. Both are shown and explained. Also described in the booklet is the recorder's a-c measuring circuit.

Fischer & Porter Company, 50 County Line Road, Hatboro, Pa., is distributing its new 24-page illustrated Catalogue 50 which describes a wide variety of primary and secondary flow instruments and control valves for all industries.

Illustrated and described are variable-area primary flow meters; frictionless, series-resonant circuit electrical transmitters; "Rato-matic" flow rate recorders, controllers and ratio controllers; "Rato-Count" totalizers; "Accuro-Batch" control systems; and "Magna-Bond" Flowrator direct-connected recorders, controllers and pneumatic transmitters.

Also covered in this catalogue is the new and improved "Pneumatrol" air-operated control mechanism and the company's line of "Valvrator" air-operated, diaphragm motor valves.

Hauck Manufacturing Company, 124-136 Tenth Street, Brooklyn 15, New York, has published a 24-page catalogue, No. 410, featuring the Hauck proportioning oil burner. The burner is intended for industrial heat processing in glass, ceramic, chemical plants, etc.

The booklet illustrates the burner and illustrates numerous systems and installations with line drawings. Many illustrations are shown by actual photograph.

H-E DIVISION APPOINTS FOUR SALES AGENTS

Plax Corporation, a division of Hartford-Empire Company, has announced the appointment of four sales agents to handle the distribution of Plaxpak squeezable, unbreakable, polyethylene bottles.

The four firms named are J. Rabinowitz & Sons, Inc., Brooklyn, New York; Zuckerman-Honickman, Inc., Philadelphia, Pa.; Continental Glass Company, Chicago, Illinois; and S. H. Ansel & Sons, South Boston, Mass.

INSULUX DISTRICT MANAGER NAMED

The appointment of A. A. Moor as District Manager of the Michigan-Indiana area for Insulux glass block has been announced by American Structural Products Company.

Mr. Moor will maintain his headquarters at the main offices of Owens-Illinois Glass Company, parent company of the American Structural Products Company. He was formerly a territory salesman.

ELECTIONS BY PENNSYLVANIA CERAMICS ASSOCIATION

At a recent Board of Directors' meeting of the Pennsylvania Ceramics Association, J. Earl Frazier, President of Frazier-Simplex, Inc., was elected President.

Other officers elected were J. K. Martin, Posey Iron Works, Vice President; Professor R. G. Ehman, Pennsylvania State College, Secretary; E. C. Emanuel, Armstrong Cork Company, Treasurer; Dr. E. C. Henry, Pennsylvania State College, Director.

L-O-F EMPLOYMENT AT PEAK NET EARNINGS MOUNT

Record high employment and payrolls, a 22 per cent increase in sales and larger earnings were reported to Libbey-Owens-Ford Glass Co. directors by John D. Biggers, President.

Mr. Biggers said that with sales up 22 per cent for the nine months ended Sept. 30 from the same period last year, employment and payrolls reached higher levels than ever before were attained.

Net earnings for the 9 months totaled $15,208,999 or $5.95 a share, compared with $9,787,417 or $3.83 a share in the corresponding 1948 period.

Heavy shipments of finished products and close control of raw materials and supplies have reduced factory inventories, it was reported.

PITTSBURGH A.C.S. SECTION DECEMBER MEETING

At the December meeting of the Pittsburgh Section of the American Ceramic Society, Francis C. Flint, Chairman of the Bleininger Award Committee, will announce the name of the recipient of the 1950 Award, which will be presented at the March meeting of the Section. The award, established two years ago, is given for distinguished achievement in the field of ceramics. To date, the late Dr. Ross C. Purdy and Dr. E. Ward Tillotson have been the recipients.

The speaker for the evening will be Hobart N. Kraner, President of the A.C.S., who will comment on the activities of the Society and also speak on "Recent Developments in Refractories".

Newark in today's picture: "Newark, the largest city in New Jersey, is the commercial, industrial and cultural center of an urban area containing more than a million people. It is the gateway through which passes the bulk of the goods and the majority of the people from the South and West, bound for New York City and New England. The growth of Newark is due to its diversified industries and its exceptional facilities for rail, air, water and highway transportation."—From the reports of the Newark Planning Board.

Banner Lime is an important element in the ever-expanding picture of Newark. About two million dollars worth of Banner Lime has been sold and used in Newark and New Jersey during the past 35 years. So many people live and work in this area that more and more homes, schools, churches, etc. are necessary to meet their requirements. Every day Banner Lime is being supplied for building construction, industrial processes and agricultural uses in and around this thriving, modern American City.

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INVENTIONS AND INVENTORS . . .

(*Continued from page* 670)

pins P forming external for the mount, and an exhaust tubulation T. The header H is placed in the machine when the chuck 12 of the "Sealex" machine spindle is released, the header at this time being supported on the heat-resistant tube 14 which is new with this invention. The shell S and mount M are assembled in contact with the header H while the chuck of the "Sealex" machine is in raised position.

The chucks 10 and 12 are rotated at times during their travel around a turret type machine. The tubulation T is gripped by jaws 16 actuated by a cone 25. The tube 14 is secured in the cylinder 20 of the "Sealex" machine. The machine has a plurality of these spindles which pass through a loading station, and heating, sealing and cooling stations. At the heating stations, the flame from a burner passes upward between a cap 26 and a ring 32 which prevents excessive heating of the exhaust tube T. At one of the subsequent heating stations, a vibratory motion is imparted to the chuck 12 to "work" the fused glass and later the chucks 10 and 12 are separated to stretch the fused joint. At other stations the glass is annealed and cooled.

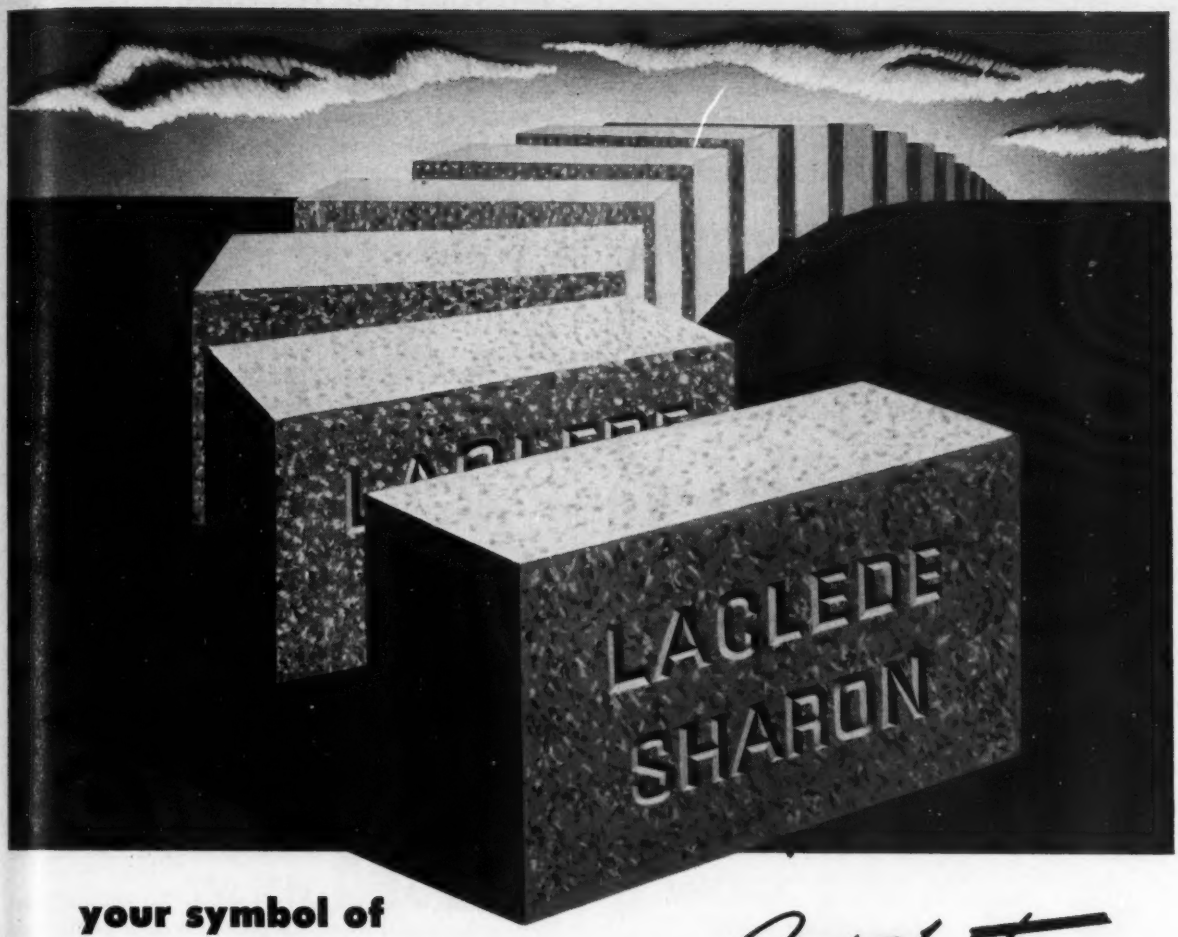
The following references are of record in the file of this patent: United States Patents: 1,542,365, Barnigan, June 16, 1925; 1,694,368, Bohner, Dec. 11, 1928; 2,143,708, Muller et al., Jan. 10, 1939; 2,215,644, Hays, Sept. 24, 1940; 2,218,254, Wengel, Oct. 15, 1940; 2,296,579, Seelen, Sept. 22, 1942; 2,321,600, Horn, June 15, 1943; 2,349,822, Gardner, May 30, 1944; 2,396,801, Morand, Mar. 19, 1946; 2,413,766, Henzl, Jan. 7, 1947; and 2,434,664, Mallory, Jan. 20, 1948.

Glass and Metal Structure. Fig. 14. Patent No. 2,482-054. This patent relates particularly to the manufacture of mirrors in which a metallic layer adheres to glass. It is the invention of W. H. Colbert, A. R. Weinrich and W. L. Morgan who assigned the invention to Libbey-Owens-Ford Glass Company.

The patent gives sixteen examples of methods of producing a bonded glass and metal article. The first example which follows, may be considered as typical.

An aluminum mirror was made by first evaporating within a high vacuum approximately 0.0033 gram of aluminum. This was deposited on glass in a vacuum of 10 to the minus 5 milimeters, the glass being 24 inches away from the tungsten filament upon which the aluminum was heated and evaporated. This gave a coating of about .000,066 gram on a square foot of glass and this coating was about 0.0003 micron thick, or a thickness of 3 Angstrom units. The coating was completely invisible and upon exposure to air rapidly oxidized to aluminum oxide. The sheet of glass thus prepared was again placed within a vacuum and 2.2 grams of aluminum was then evaporated onto the glass from another tungsten electrode. This gave a coating of aluminum on top of the aluminum oxide which amounted to .044 gram aluminum per square foot and was 0.1750 micron thick. To all appearances, the mirror thus produced was identical with a mirror produced by directly evaporating 2.2 grams of aluminum onto glass, the reflectivity in each case being 89%. However, the mirror produced with the oxide layer

(*Continued on page* 680)



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INVENTIONS AND INVENTORS . . .

(*Continued from page* 678)

next to the glass was tightly adherent and the simple aluminum mirror was relatively poor in adhesion.

Figure 14 shows a glass base 13 having a thin layer 14 of a suitable metallic compound such as in the above example and a thicker film 15 of an opaque metal. The layer 14 causes the film 15 to adhere substantially permanently to the glass 13.

The following references are of record in the file of this patent: United States Patents: Re. 22,076, Cartwright et al., Apr. 21, 1942; 1,008,902, Haehnel, Nov. 14, 1911; 1,698,307, La Hodny, June 8, 1929; 1,884,665, Greiner, Oct. 25, 1932; 2,010,145, Eitel, Aug. 6, 1935; 2,030,476, Smith, Feb. 11, 1936; 2,047,351, Alexander, July 14, 1936; 2,278,722, Loiseleur, Apr. 7, 1942; 2,304,182, Land, Dec. 8, 1942; and 2,394,930, McRae, Feb. 12, 1946. Foreign Patents: 508,205, Great Britain, Dec. 7, 1938. Other References: *American Physical Society*, vol. 14, No. 2, April 1939, page 24.

SHOCK-PROOF CARTON EXPERIMENT

A new type of carton, suitable for the packing of electric bulbs, was recently put to test for its shock-absorbing quality when sixty-four electric bulbs were dropped from an airplane at 2,500 feet in England. Only one bulb was damaged, but even then the glass remained intact.

The carton is the invention of Harry Bradley, a packaging expert employed by John Waddington, Inc. Of the bulbs dropped from the plane, fifty-two were dropped in single cartons and the remaining dozen in two cartons of six.

The lamp is pushed into an oblong carton and interlocking flaps meet round the neck to hold it firmly dead center. The top of the bulb rests against four tiny shock absorbers; the rest of its surface makes no contact with the carton at all. The cartons can be manufactured for three-quarters of a cent and at the rate of 36,000 per hour.

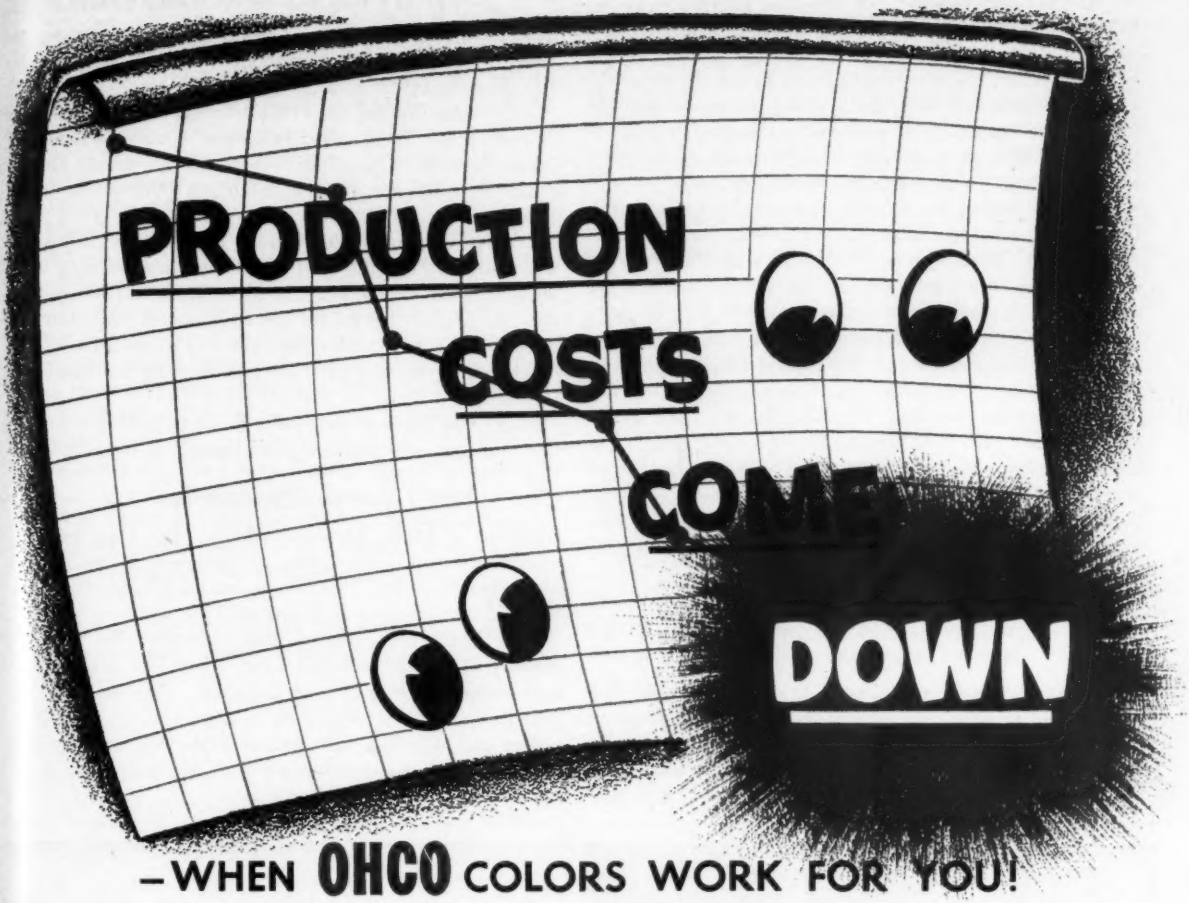
NEW OWENS-CORNING BOARD MEMBERS

Five new members have been named to the Board of Directors of Owens-Corning Fiberglas Corp. to succeed four former members who have resigned. Harold Boeschenstein, President, continues on the new board. New members are:

Frederick M. Eaton, partner in the New York law firm of Shearman & Sterling & Wright; John E. Bierwirth, President of the National Distillers Products Corp.; George Keith Funston, President of Trinity College; James M. Kemper, board chairman, Commerce Trust Co.; Robert T. Stevens, board chairman of J. P. Stevens & Co., Inc., and vice president of the Association of Cotton Textile Merchants.

The new directors replace W. E. Levis, Board Chairman of Owens-Illinois Glass Co.; Amory Houghton, Board Chairman of Corning Glass Works; U. E. Bowes, an Owens-Illinois executive, and Glen W. Cole, Vice Chairman of the Corning Glass board.

All resigned in accordance with terms of a Federal Court consent decree resulting from the Government's anti-trust suit against Owens-Corning.



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OPTICAL SOCIETY FALL MEETING . . .

(*Continued from page* 665)

erties of echelles a year ago, it has been found that the problem of making one is difficult. He announced the partial success of a group of workers at Bausch and Lomb Optical Company in producing echelles and reached his climax by showing two echelle spectograms. Other groups are working on their production.

The dinner meeting was enlivened by another scene in the psuedo-feud between Dr. Meggers and Dr. Harrison over which is the greater spectographer. Dr. Meggers was installed as the President of the Optical Society replacing Dr. Kingslake who has served for the past two years.

Conventioners ran into rationing in the fact that a planned visit to Niagara Falls was cancelled. The Canadian Government had cancelled the illumination of the Falls for lack of power. However, they reversed themselves and allowed illumination on Saturday evening so that those who wished to see the Falls at night did have that opportunity.

KIMBLE GLASS PLANT UNIT MOVES TO NEW JERSEY

Officials of Owens-Illinois-Glass Co. have announced that the Kimble Division plant at Conshohocken, Pa., employing approximately 140 persons, will be moved to Kimble's Vineland, N. J., plant. The move will be completed about Dec. 1.

PPG SUPERINTENDENT RETIRES

The retirement of James Green, following forty-seven years' service, has been announced by Pittsburgh Plate Glass Company.

Mr. Green joined the firm at Creighton in 1902 as a "booker" and three years later was appointed assistant superintendent, a position he held for 35 years. He became Superintendent of Pittsburgh's Works No. 1 at Creighton in 1940.

During Mr. Green's service, the Allegheny Valley plant was completely built, and many new innovations were introduced at Creighton. David G. Hill, Superintendent of plate glass factories for the firm, stated, "Mr. Green's contributions to the development and perfection of the continuous system of producing plate glass has been outstanding".

Named to succeed Mr. Green is Thomas K. Gregorius, first assistant superintendent at Creighton since 1922.

L-O-F STOCK REPORT

Directors of Libbey-Owens-Ford Glass Co. have declared a dividend of $3.50 a share, payable Dec. 10 to holders of record Nov. 25. This brings total payments this year to $5.75 a share compared with $3.50 in 1948.

The higher disbursement reflects 1949 sales to date, already above the total sales for all of last year, which have resulted in increased earnings, the company reported.

The company 9-month statement showed net earnings were $5.95 a share compared with $3.83 for the same period last year.

ECONOMIES

BORAX . . . the economies of a B_2O_3 addition should not be measured solely by the cost of the raw material but by an evaluation of the improvements and beneficial effects resulting from its use.

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RESEARCH DIGEST . . .

(*Continued from page* 671)

inch slabs and 3mm. diameter rod samples and to test the slabs immediately for density while the rods for the expansion test are being annealed. If the result of the density determination is favorable, production is commenced immediately, but if the result indicates that there is a possibility of the expansion properties being outside the specified limits, production is delayed a further 90 minutes until the result of the expansion test is obtained.

In the case of glasses containing PbO, BaO, or ZnO, the density value may fluctuate outside the target range (for a small change in composition), while the effect on the thermal expansion value may be so little that it falls within the limits of experimental error. In these glasses then, the determination of density is a control on the side of safety.

This work indicates that density determinations, because of the ease with which they can be carried out, can be employed for primary control and the thermal expansion measurements desirable for purposes of confirmation can be made at less frequent intervals.

• Metro Glass Containers, Inc. has announced the change of its firm name to Metro Glass Company, Inc., effective immediately.

• Harold Boeschenstein, President of Owens-Corning Fiberglas Corporation, was elected third Vice President of the National Security Industrial Association at its sixth annual meeting in New York.

FTC PASSES ON USE OF WORD "CRYSTAL"

Following a protest by the American Glassware Association concerning the use of the word "crystal" in connection with plastic stemware, the Federal Trade Commission has issued a statement denying the use of the word "crystal" when applied to plastic stemware.

Should any such advertising appear, the FTC requests that it be brought to its attention where it will receive appropriate consideration.

HOLOPHANE NAMED IN ANTI-TRUST ACTION

Attorney General J. Howard McGrath has announced the filing of a civil anti-trust action in the Federal Court at Columbus, Ohio, charging the Holophane Company, Inc., with violating the Sherman Act by engaging in world-wide cartel agreements restraining the manufacture and sale of prismatic glassware and illuminating appliances containing prismatic glassware.

Holophane, Limited, of London, England, and La Societie Anonyme Francaise Holophane of Paris, France, were named as co-conspirators. The government's complaint charges that the Holophane Company has conspired with the co-conspirators to divide the markets of the world into non-competitive areas each assigned to a member of the conspiracy, thereby eliminating competition in the manufacture and sale of these products.

• J. Earl Frazier of Frazier-Simplex, Inc. has been elected President of the Society of American Competitive Shooters. The society, in conjunction with the annual convention of the National Rifle Association, fosters local and national rifle and pistol competition.

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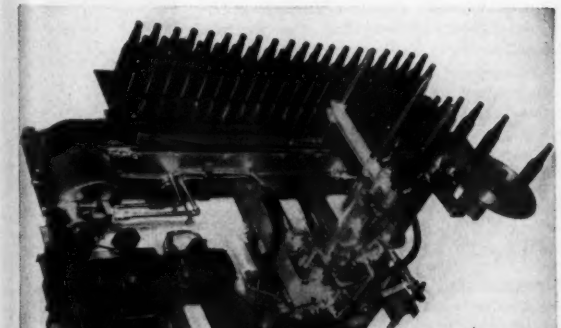

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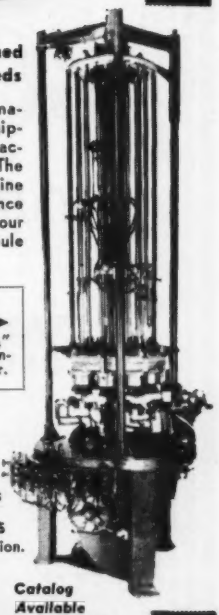

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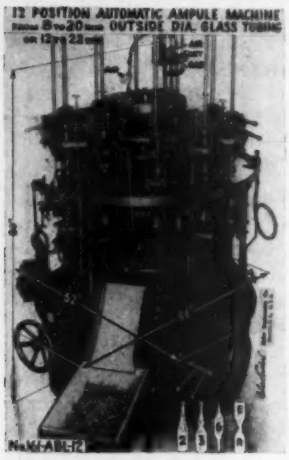
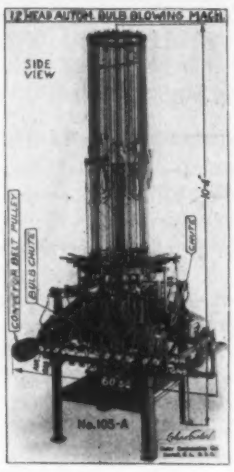
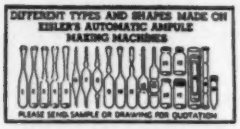
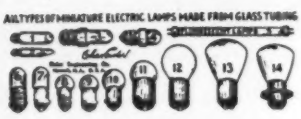





DIFFERENT TYPES AND SHAPES MADE ON EISLER'S AUTOMATIC AMPULE MAKING MACHINES
PLEASE SEND SAMPLE OR DRAWING FOR QUOTATION



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DECORATION OF GLASS AND CERAMIC ARTICLES BY XEROGRAPHY . . .

(*Continued from page* 664)

Resist for Etching

Many of the resin powders now used in xerography are acid resistant. Images may be applied to glass by the standard xerographic techniques. When fused the powder image forms an acid resistant coating. The uncoated areas of the glass may then be etched by standard techniques.

Conclusion

Xerography and xeroprinting are still in an embryonic stage of development. Considerable research and development are still required to refine many of the applications. Accordingly, the above applications are not presented as being completed developments ready for production use. It is not expected that xerography will displace any of the present processes of decorating glass. Instead, it should supplement the productivity of the present processes and create new fields of application and new markets.

• The Peoples Natural Gas Company has completed more than 80 per cent of its three-year $19,900,000 program of expenditures to increase natural gas supplies and improve service to its more than 200,000 customers throughout Western Pennsylvania, according to Christy Payen, Jr., Vice President.

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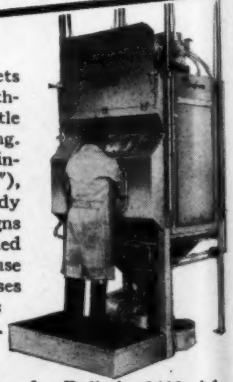
GLASS MOLDS
with less hand polishing



PANGBORN *Hydro-Finish* gets glass molds *cleaner* than other methods. Cleaning is fast because there's little or no need for additional hand polishing. Sharp edges and contours are maintained during cleaning (tolerance of .0001"), leaving molds bright and smooth, ready for use. Complicated molds or designs are easily cleaned *throughout* because Hydro-Finish uses fine-mesh abrasives suspended in water.

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Two Amsler Morton lehrs—48" width belt—60 foot tunnel—16 ft. packing table. Both in good condition. May be seen in operation. Available for delivery January 15, 1950. Price $2000.00 each. Reply Box 97, c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

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GLASS TECHNOLOGIST, B.S. Alfred University, desires new position preferably in East. Five years varied experience in development, furnace operation and control, general glass plant technology. Reply Box 98, c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

CARR-LOWREY HONORS OLD EMPLOYEES

The Carr-Lowrey Glass Company recently held a recognition dinner in honor of its employees with 25 years or more of continuous service. Forty-seven employees, some retired for several years, were presented with appropriately engraved gold watches.

The oldest employee in terms of years of service is Charles Vanskiver, who started work for the company on April 1, 1889, the day the company was founded. Another impressive service record is that of the four Polk brothers, who together have a total of 150 years of company service.

Carl R. Hilgenberg, Vice President of Carr-Lowrey, was Toastmaster. Presentation of the service awards was made by George F. Lang, President of the firm.

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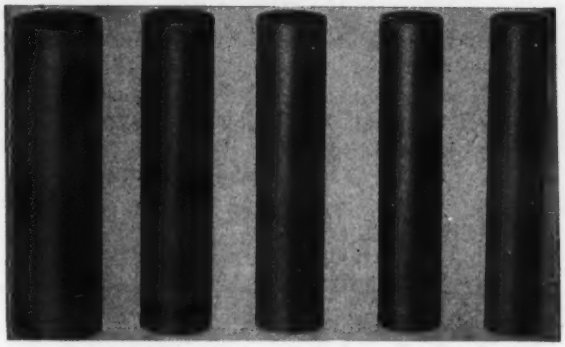

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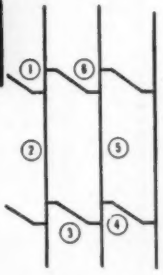

Each Super-Concrete Stave in a Neff & Fry Silo interlocks with six contiguous ones. The edges are grooved and beaded. The joints are so secure that grouting is not necessary, although a mastic filler is used when damp-proofing is specified.

Due to the diagonal joints, reinforcing rods impinge upon both ends of all staves. As many additional rods are drawn around the bodies of the staves as needed to resist lateral pressure.

This patented design makes the N & F Silo a structure of distinctive strength and solidity. The corrosion-resistant materials assure long life with virtually no maintenance cost.

It will pay you to get complete information. Write, wire, or phone.

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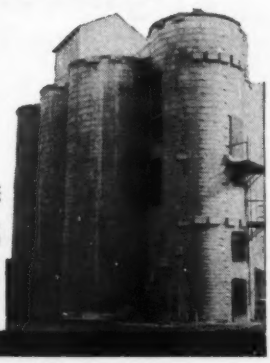

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FOAMGLAS TO BE USED IN CAPITOL ROOFING

Over an acre of Foamglas is being used to permanently insulate the new roofing project over the Senate and House sections of the U. S. Capitol Building in Washington, according to an announcement by officials of the Pittsburgh Corning Corporation.

Twelve by eighteen inch blocks of Foamglas insulation, two inches thick, will be placed over the entire area. Foamglas is composed of millions of tiny glass cells filled with still air. It permanently insulates against moisture, vapor and fumes; it is non-combustible and verminproof.

SYLVANIA THIRD QUARTER REPORT

Sylvania Electric Products, Inc. has reported a consolidated net income of $356,530 for the third quarter of 1949. This is equal to 18¢ per share on the 1,456,550 shares of common stock outstanding for the quarter, after deducting dividends of $1.00 a share on the $4 cumulative preferred stock.

This compares with a consolidated net income of $613,415, equal to 46¢ a share, earned on the 1,119,593 average number of shares outstanding during the third quarter of 1948.

Third quarter net sales of $23,375,692 compare with sales of $23,524,962 for the third quarter of 1948. For the nine months ended September 30, 1949, sales of $73,041,240 compare with sales of $71,735,038 for the nine months ended September 30, 1948.

OWENS-ILLINOIS EARNINGS GAIN FOR 12 MONTHS

Net earnings of the Owens-Illinois Glass Co. for the 12 months ended Sept. 30 totaled $15,067,584 or $4.93 a share, compared with $8,319,893 or $2.72 a share in the preceding 12-month period, William E. Levis, Chairman, has reported.

"Improvement in earnings of some of the company's divisions and subsidiaries, resulting from placing some of their new developments and facilities in operation, contributed to the gain in the current period," Mr. Levis said.

Directors declared a dividend of 75 cents a share payable Nov. 15 to holders of record Oct. 30.

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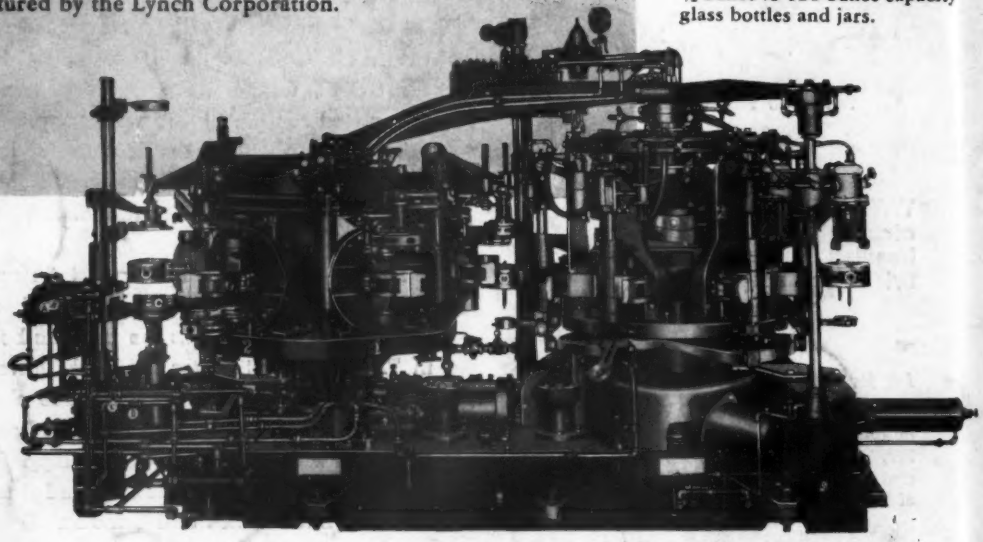

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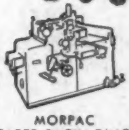

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